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Table of Contents

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ORIGINAL ARTICLES— PAGE.

"Tuberculous Hip," by R. B. WADE, M.D., Ch.M., F.R.A.C.S. 799

"Tuberculous Disease of the Hip Joint," by D. J. GLISSAN, M.B., F.R.A.C.S. 803

"A Report on the Use of Gas Anæsthesia, 1925-1930," by GEOFFREY KAYE, M.D. 804

"Extrarenal Factors in Diuresis," by C. STANTON HICKS, M.Sc., M.B., Ch.B., Ph.D. 810

"Saturnine Renal Dwarfism," by L. J. JARVIS NYE, M.B., Ch.M. 813

"A Note on an Alleged Action of Orally Administered Insulin," by BASIL CORKILL, M.B., B.S. 816

REPORTS OF CASES—

"Dercum's Disease (Adiposis Dolorosa)," by KEMPSON MADDOX, M.D., M.R.C.P. 817

REVIEWS—

The Surface of the Body and its Movements .. 818

The Pathology of Bone 818

LEADING ARTICLES—

Prospect 819

CURRENT COMMENT— PAGE.

The Control of Tuberculosis 820

SPECIAL ARTICLES ON AIDS TO DIAGNOSIS—

The Widal Test 821

BRITISH MEDICAL ASSOCIATION NEWS—

Scientific 823

CORRESPONDENCE—

Sterilization of the Unfit 825

Trauma and Organic Visceral Disease 827

The Hospital Problem 827

BOOKS RECEIVED 828

MEDICAL APPOINTMENTS 828

MEDICAL APPOINTMENTS VACANT, ETC. 828

MEDICAL APPOINTMENTS: IMPORTANT NOTICE 828

EDITORIAL NOTICES 828

TUBERCULOUS HIP.[1]

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ANY discussion on the treatment of tuberculous hip at the present times resolves itself into the question of conservative *versus* operative methods.

Conservative Treatment.

The methods adopted in the conservative scheme may be shortly described: First, immediate rest in bed, and should there be any deformity, the correction by means of weight extension or splints to give the best position, namely, the most suitable for the stage of the disease as it then exists.

The question comes as to how long recumbency should be maintained, and perhaps a fair basis for consideration of the question is to divide the course of the disease into three stages: (i) The period of onset, in which the disease is actively progressing in spite of all treatment, and this period lasts, roughly, up to two years. (ii) A period of, again roughly, two years, during which the disease is stationary, or in which it varies, remaining stationary, with occasional periods of renewed activity. (iii) A final stage, when cure is going on and active bone organization is present.

There can be no question that during the first period and part of the second, when the disease is active, as is evidenced by symptoms and by the result of the X ray examination, recumbency is necessary; and, though it may be regarded as a slur on our methods of splinting, I think that during all the stationary period the patients should still be kept recumbent, and it is only when active bone formation is going on that locomotion should be allowed.

The stage of recovery is that which gives much thought as to the best methods of treatment. Undoubtedly, cure will be more quickly effected if the patient is up and about, getting work for his

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on October 29, 1931.

muscles to do, as in that way the general condition improves more rapidly and attains a higher level, and so the child is better able to combat and cure the disease. This is particularly marked in cases of long continued suppuration, when the sinuses, which, perhaps, have been present for years, will soon close—a matter of a few months only once locomotion is allowed. But, on the other hand, it must be confessed that methods of splinting are not sufficient during this stage to prevent deformity developing, and a limb which during recumbency was at full extension at the hip with slight abduction, is dragged over into a position of flexion and adduction deformity. This applies whether weight-bearing is permitted or not. If weight-bearing is allowed, the deformity perhaps is more marked.

I think the advocates of short periods do so rather on account of the inability to find the hospital bed accommodation that is necessary to permit of a prolonged recumbency.

These children should always be fed as well as possible, provided with food that will appeal to their appetite, so that they get a greater quantity than the normal, and, secondly, be given at least a quart of milk with some cream added in addition to the ordinary food. Cod liver oil, too, is used as a routine. In this country, however, on account of its liability to upset the digestion and cause nausea in the hotter months, it should only be given during the winter.

Treatment by heliotherapy has been the one great advance of later years, advanced first of all owing to the advocacy of Rollier, of Leysin in Switzerland, and is now universally adopted as one of the most powerful means we possess to improve the child's general condition and so shorten the disease. There is no question but that these children under heliotherapy become in every way improved; they fatten, their muscles fill out and they become smooth and soft-skinned. Whether heliotherapy under the clear sky and high altitude is of more value than that in the region of the sea level remains to be seen. Rollier is of the opinion that it does not make much difference, but he has a preference for high altitude. He further considers that it is not a question of any special type of ray, but rather a combination of the rays of the whole spectrum. In addition, however, to the question of altitude must be considered the effect of environment on the child's mentality. We have in the past tried inland treatment with these children and have found the monotony of the bush has had a harmful effect on them, that they tended to lose flesh, lose interest, and did not thrive; whereas the constant change of scene on the sea shore, the vessels, surf bathing and the changing kaleidoscope of humans and animals are all a source of interest to stimulate the child's mentality, and this undoubtedly has a great deal to do with the cure. "Hospitalization" may occur and a change from the dull routine of hospital to a poorer home, where they are not so well cared for, will in some cases mean an immediate improvement in their general condition, due entirely to the altered mental outlook.

As regards splints, the multiplicity of splints that exist for the treatment of tuberculous hip are, I think, a sufficient tribute to their inefficacy as fixation agents. Extension is one of the best forms of fixation we possess. Splints, however, are all exoskeletons, which have to act on the bones and joints through a very considerable layer of soft tissues and naturally cannot be of absolute value.

Tuberculin has come and gone and is practically discarded in all large clinics, no improvement that could be considered worth while having been found from its use.

We have, then, in the conservative treatment as the main factors prolonged rest and sun-baking.

Have we yet more to learn about sun-baking? And I think the answer is in the affirmative. We expose these children fully to try to get them completely sun-baked back and front—all the skin, with the exception of that covered by a small pair of bathing "V's." In what way does the sun-baking act? Is it the action of the ultra-violet rays and activation of ergosterol, or are all the rays necessary, as Rollier suggests? Has it any specific action on the infection by tuberculosis? Probably its action is by its effect on the general nutrition; the reaction to both the sun and the wind and the consequent effect on the general metabolism play a considerable part. Whether it is necessary to sun-bake the whole of the child's body and how long the exposure should be maintained are still questions that need further investigation. A point of interest is that a large proportion of tuberculous children are of the sandy-haired, freckled type, who do not become pigmented on exposure to the sun, but only redden and blister. Is it that their complexion, with its inability to become pigmented freely, leaves them more liable to tuberculous infection and that, as seems to be the case, once infected they do not tend to recover so easily as others?

What then, are the results that can be expected as the result of conservative treatment?

Mortality.—Estimates of mortality vary. Hibbs, in an estimate of a series of cases followed over many years of bone tuberculosis, gives a mortality of 24%; Rollier, Calvé and Gervain give a mortality of somewhere between 2% and 3%; the mortality taken at the Royal Alexandra Hospital for Children in 99 separate cases over the past ten years gives seven deaths, practically a mortality of 7% during their attendance at hospital.

Duration.—It is very difficult in any series of cases to estimate the average duration of the disease; however, an average of these 99 cases was of 723 days' stay in hospital. What the full duration was in these cases is impossible to say.

Final Results.—The most important question in any case of tuberculous disease of the hip is the condition in which the joint will be left after the tuberculous process is at an end. Do the patients recover with full movement and full repair of the

articular surfaces? Do they recover with complete disappearance of the tuberculous foci but with good bony ankylosis? Or do they recover with fibrous ankylosis and remnants of the tuberculous foci encapsulated.

It may be said that recovery with full movement but rarely occurs. When it does occur, the neck of the femur is affected and the articular surfaces do not become involved. This is rare, but there are certain cases in which the neck is involved but the joint remains unaffected.

Destruction of Bone.—What is the result as regards destruction of bone and loss of length of the limb? This varies enormously and, in spite of all our splinting and methods of treatment, a great number of these patients have the whole head and neck affected. There may be "wandering" of the acetabulum, and when cure is finally attained, it is in the form of some ankylosis, whatever it may be, which is accompanied by very pronounced shortening and absorption of the head and neck of the femur. Practically always there is some shortening as the result of the softening of the bone and crushing by muscular action—the "compressive ulceration" of the French.

Mobility.—What are the results as regards movement or ankylosis? Rollier claims that he gets movement in a great majority of his cases, and shows various series of photographs to illustrate his contention. Others claim that ankylosis of some kind is always the final result. My own experience is that, saving the few rare cases in which the articular surfaces are not attacked, ankylosis, whether bony or fibrous, is inevitable, and that a good, firm bony ankylosis in the position of election is the best result to be hoped for.

Ankylosis.—If, then, as I feel convinced is the case, there is in most instances some destruction of the articular surfaces and union of some sort or other will occur, what are the different varieties? There may be a strong bony ankylosis; there is a type with calcareo-caseous union, in which there are masses of caseous tuberculous material deposited in the bone that has not become absorbed or surrounded by fibrous tissue, but becomes surrounded rather by calcified material, and this calcified material itself remains calcified and is never regenerated into new bone. Then there is the type in which cure is effected by fibrous tissue surrounding and entering into the caseous tuberculous matrix. This fibrous tissue gradually becomes infiltrated with bone cells; it, too, joins up the affected articular surfaces, but the union may not be quite complete and may be mainly of fibrous tissue; this leaves the patient with very limited movement; and any movement that there is is rather a source of weakness and trouble, as excessive activity may readily traumatize the union.

The calcareo-caseous type, of course, leaves a very bad result.

Then the most interesting of all is the condition of ankylosis that appears when sepsis has been present. In these circumstances there is complete wiping out eventually of all the tuberculous material and a strong bony union which becomes trabeculated and altered according to Woolf's law in continuation of the bone above and below, and this gives the most stable, best form of ankylosis that would be wished for. Obviously sepsis has its dangers; in the case of many it is fatal; it prolongs the period of disease, accentuates the condition of ill health during the condition; and yet, curiously enough, it is the one that always gives the best final result.

Occasionally there is such marked absorption of the head and neck that the trochanter and shaft of the bone become dislocated upwards and the union by fibrous tissue is so slight that there is practically a condition similar to that following an excision of the joint. This, too, gives an exceedingly bad result from the point of view of function.

Final Angle of Ankylosis.—An interesting point as regards ankylosis is this: the children cannot be kept in bed until full bony union has occurred; they are allowed up during either the second or third stage, and then, in spite of splinting, whatever type is used, muscular action causes a deformity. The effect is that the joint is pulled in certain directions and one always gets some deviation of the femur in these directions owing to the softness of the union, and the deviations are always of flexion and adduction. The common flexion deformity is really a blessing in disguise, provided that it is not beyond 30° or 35°. It enables the patient to sit down with comfort, to get about in vehicles, such as trams or trains; and, when the optimum position in a fixation of the hip joint is desired, flexion of 30° to 35° should be sought.

The adduction deformity, however, is a grave one, and it adds considerably to the relative shortening of the leg; and consequently, if there is any actual shortening, abduction should be sought for to counteract the shortening according to the degree, and an effort should be made, though generally it is not successful, to maintain this degree of abduction.

The fact must be clearly appreciated that in most cases there comes a time, usually during that of ambulation before strong union is effected, when the muscular pull on the soft tissues causes deformity, and this is always flexion and adduction.

With the knowledge of deformity that arises in the later stages of the disease, it must always be kept in mind that after the disease is at an end, no patient can be considered functionally cured if the best possible position of the limb is not obtained, and that, when cure of the focus has occurred, a great number of these patients will need operation in the form of an osteotomy to place the limb again in the most suitable position to insure the best function. This operation cannot, however, be done when the union is soft and should be performed only after strong bony union has occurred, and not at the period when the pull of the muscles may restore the deformity after the osteotomy has been performed.

Function.—What is the best function, then, that can be expected of these limbs? If finally the limb is fixed strongly with some flexion deformity, if some abduction is present to compensate for the shortening and if a good bony union has occurred, there will be a perfectly good functional limb that will allow anything in the way of walking and even the less strenuous forms of games.

When, however, there is some movement, but of a limited degree, pain is experienced and the result is not so good as when complete ankylosis is present, nor is an operation of osteotomy indicated, because the soft fibrous union of the joint still exists and a tendency to recurrence of deformity will be present.

Recurrence.—Where there is not a strong bony union, is there a tendency to recurrence of disease? At this point I must frankly confess I have no experience at all. Children leave the hospital at the age of thirteen years, and in most cases one has no oversight of them later on. But the number of patients with tuberculous hip seen in adult hospitals after that age is few, and the recurrence of the trouble cannot be very great. Thus the liability to lighting up of a focus that has been encapsulated either by calcareous or fibrous tissue apparently is not great, but there is no doubt that it does sometimes occur. What the percentage is, however, I do not know. The exponents of the operative school state that relapse of the disease is common and use this as one of their main arguments for the need to do something to fix the joint firmly by a form of internal splinting.

When we consider the results of conservative treatment, both as to the mortality, time and final results, especially of shortening, deformity and disability, we must confess that they are not anything to be proud of, and that any method that will give better results is to be hailed as something very desirable.

The question is, will operation, as we know it at present, do any better? And what is the position of operation in these present days?

Operative Treatment.

Operation, of course, has as its aim a bony ankylosis, either by an intraarticular or, as is more generally done, by some extraarticular means of fixation, a bridge of bone being thrown between the femur and the *os innominatum* that will hold the joint absolutely at rest. Could this be obtained easily, one could easily envisage that the resulting absolute rest would shorten the period of the disease. Further, one would imagine that, once the disease was arrested, a strong bony bridge being attained, muscular action and weight-bearing would not permit the crushing of the head and neck by joining the surfaces together; consequently the reparative process, which would finally go on to ankylosis and new bone formation in the head, neck and acetabulum, ought to do so with less expense of tissue and less shortening—there should be no "wandering" of the acetabulum and less pull into deformity.

The next point is, does it shorten the period of disease? After seeing a series of skiagrams of the spine, when a fusion had been done and a few odd skiagrams of tuberculous hip after a similar procedure, it would seem as though the stationary period is reached soon after the operation has caused complete rest, that is, after the bony ankylosis is firmly established, and I think that in this respect the operation has its advantages.

Does it, however, make any alteration to the final cure? Are there less cases of caseo-calcareous union? Are there less cases of fibrous union? Does it give better ankylosis that is more likely to take weight? Is there less liability of septic infection? Time alone will show how these operations will answer these questions.

Are operative methods, as we know them at present, absolute? And I think the answer to that is definitely in the negative. Fusion of the spine by various methods has been going on for many years, and yet the number of failures to secure fusion are many, some patients being operated on two, three or four times before fusion is finally secured. Fusion of the spine is a fairly standardized operation, whereas that of fusion of the hip is still experimental, and the number of failures to secure fusion are infinitely more common than with fusion of the spine.

The various methods of hip fusion are the intraarticular methods, the method of a flap turned down from the ilium to be wedged in the trochanter, the sliding up of the trochanter on to the raw surface of the ilium, or the boring of a tunnel through the back of the trochanter and the pushing of a graft through this on to the ilium behind the joint. Of them all, the last would seem the more feasible, but it is an operation of some severity.

It is doubtful whether any of the present methods yet provide a bony union between the ilium and the femur strong enough to stand up to the strain of body weight unaided and to allow splints to be discarded. When this difficulty is overcome, undoubtedly better results will be secured.

To acquire the technique of such an operation needs a well-supplied and trained clinic, where the operation is done frequently and becomes a routine, when all the possible sources of error are well estimated and allowed for; and it is only a surgeon doing this operation frequently who will get a meed of success.

It can be definitely laid down that the younger the patient, the more difficult it is to secure a bony union that will remain stable. Tuberculous hip occurs most commonly between the ages of five and fifteen. One may say that fusion is the best treatment for adults; this has been proved in tuberculosis of the knee and spine. In children, however, it is necessary to evaluate first of all its effect on growth, secondly, the difficulty that exists in securing fusion as a routine in these cases, and thirdly, the condition that may be called juvenile callus. When some bony union has occurred in young children, it remains soft and deformity may occur when

weight is taken, and this may necessitate the wearing of splints for a long while after the operation.

The general feeling elsewhere, as far as I can gather, is that fusion operations are to be advised for adults. It is recognized that it is difficult to attain fusion in the hip. In regard to children the opinion is very varied, but on the whole opinion is against operation in the young, mainly for the reasons of the difficulty of obtaining fusion and the difficulty of obtaining a strong bony union.

Points to be considered in operation are whether the period of after-splinting is diminished and the period of recumbency lessened. In the early days all the patients submitted to fusion operations were promised that splinting could be discarded in about three months. It is interesting to note that the time is gradually increasing during which a retention splint is used. It is unlikely that weight can be taken on these at an early date. This is particularly true after a hip fusion, when the bony bridge is not strong and must take a very considerable time to hypertrophy sufficiently to take the body weight.

The strongest argument for operation that has so far stood the proof of trial, is that, though protection splints are still needed, the period of rest in bed can be shortened and locomotion allowed at an earlier date.

What, then, must be considered about the question of operative treatment? First of all, it must be acknowledged that there is room for very great improvement on conservative methods. Whether the operative method of fusion is going to succeed it and supplant it is still open to question and can be determined only as the result of experimentation. The operation, as we know it now, is not yet to be considered as a better method of treatment than the conservative methods, but has to be improved. Results can be worked out, not by an odd operation done here and there, but only by careful experimentation and tabulation of results, both of conservative and operative methods in clinics where a large number of these operations are done, where the technique can be standardized and the after-treatment, and comparison of the after-results made after the patient's discharge from hospital to the final end. In this way can be seen and tabulated: what was the final condition of the joint, what was the functional condition, what patients relapsed, and, lastly, to what cause death was due.

Finally, it is obvious that our hospital methods are not yet designed for scientific recognition of results. To do this needs a properly equipped follow-up department, where each patient can be traced, where treatment is recorded and where the patient is traced from discharge from hospital to final cure, to see what function has resulted, what recrudescence has occurred and what is the end in each instance.

TUBERCULOUS DISEASE OF THE HIP JOINT.[1]

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THE invitation to read this paper reached me too late to permit of my preparing an exhaustive and detailed review of the subject, but I must confess that had the time been ample for this, I should still have wished to deal with the question in the following general and, I fear, somewhat disjointed fashion.

I propose to bring to your notice a number of facts about this disease which are already well known to us, so well known in fact that they have become commonplace and we are in danger of overlooking their importance. I have no fear that a little time spent in taking stock of them may be time well spent.

Fact Number One.

Tuberculous disease of the hip joint is a local manifestation of a general disease process. The truth of this is frequently borne home to us when, during the course of a painstaking treatment of disease affecting one hip, we find the process manifesting itself in another joint, the lungs, kidneys or other organs.

We tend to lose sight of this important conception and to concentrate our attention too much on the affected joint.

I make bold to say that as far as the great public hospitals of this city are concerned, and I except the Royal Alexandra Hospital for Children, the system under which we work makes it impossible for us to do anything more than attempt to deal with the local condition. To admit a patient to hospital twice or thrice in a year to change or readjust his or her apparatus, and to check progress radiographically, is not to treat the disease adequately. We have no control over the conditions under which patients live outside hospital, and very often these must be sadly lacking in the essentials of sound mental and physical hygiene.

There is urgent need in Sydney for a convalescent hospital for adult patients, with accommodation for suitable patients with tuberculous disease of joints.

Fact Number Two.

Tuberculous disease of the hip joint is a long-standing and slow process. When the disease is correctly diagnosed, the subject of that diagnosis faces a serious illness whose course must be computed in years and never in months. There is no such thing as a short attack of tuberculous joint disease unless death intervenes.

Admittedly a grave responsibility rests upon us when we diagnose this condition, but a still graver one is to see that there is no slackening in our vigilance, no compromise, until cure of the local and general disease is complete. This point brings

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on October 29, 1931.

us naturally to the consideration of two questions: (*a*) diagnosis and (*b*) the standard of cure.

Let us consider diagnosis. Tuberculous disease of the hip manifests itself as a rule in early life, and of paramount importance are a careful history and a study, over a period if necessary, of clinical signs in the case of a child or young person who complains of a limp and of pain in the hip region or knee, or both, whereas the absence of radiographic evidence of change in the bone is of the slightest importance.

The temptation to dismiss the possibility of tuberculosis in the presence of signs of irritation in the hip joint and of a perfectly normal looking radiogram must be guarded against.

Tuberculin tests, particularly in children, are of value and should be resorted to in doubtful cases. Our American colleagues, with their usual thoroughness, go to the length of submitting to biopsy patients in whom the disease is suspected, but I do not think that such radical measures to substantiate a diagnosis would be tolerated in this country, nor am I persuaded that they are necessary, except in a few well chosen cases, but at least the American attitude serves to stress the importance of correctly diagnosing the disease as early as possible.

In regard to the standard of cure, there is abundant evidence to support the view that when we find the femur and pelvis united by fully organized and matured bone, we are justified in assuming a cure of the local disease. Here the radiographer comes into his own, for his dictum is more weighty than the clinician's at this stage, provided he uses the term bony ankylosis with care and judgement, reserving it for those cases in which he can demonstrate unbroken trabeculæ carrying the stresses from the femur direct to the pelvis.

It may be that there are some forms of tuberculosis in which bony ankylosis never takes place. It may be also that some of the patients reported from Rollier's clinic as cured, with movement at the joint, are actually cured and will not show recurrence of disease in two or three or twenty years, but in this country true bony ankylosis, very rightly in my view, constitutes the standard of cure.

Fact Number Three.

Tuberculosis as it affects the hip joint is an inflammatory process, and the basis of our treatment must be rest, complete and uninterrupted, from function, that is, from movement and weight-bearing.

Dr. Wade has dealt fully with the question of treatment, and this gives me leave to state fact number three thus baldly as the *motif* of his excellent discourse, and to pass straight to the next two fundamentals which also have formed part of the groundwork of his theme.

Fact Number Four.

Tuberculosis of the hip joint is a deforming disease. The deforming process or tendency commences at the very outset of the disease and persists until bony ankylosis is complete. Let me emphasize this point by putting it in another way. It matters not how long and how carefully we have immobilized the affected joint, how well the patient appears, and how firm the joint feels on clinical examination, if bony ankylosis is not complete when we at last free the joint, deformity will supervene.

Let me utter a warning as to the use of Jones's abduction frame. The mere application of this frame to a patient suffering from this disease will not prevent deformity. On the contrary, a very severe degree of flexion adduction deformity can very easily develop in a patient treated on this apparatus. If it is to function adequately, two things are necessary. The frame must be made to fit the patient carefully, and in a child, to make provision for its growth, constant watchfulness on the part of the surgeon and one responsible attendant must be assured.

In general hospital practice I think that most of us trust to a well applied plaster spica to immobilize the joint and to check deformity, and indeed I prefer such an apparatus to a Jones's frame. It has the great disadvantage that an abscess may develop undetected to a large size beneath it, and this possibility calls for fairly frequent changes and reapplications of the apparatus. I should like to think that every graduate of our school and hospitals left our care equipped with the knowledge to enable him or her to apply a spica in satisfactory fashion if the need should arise.

I have spoken of deformity in general terms as an aftermath of tuberculous disease of the hip, and I have mentioned that bony ankylosis constitutes the standard of cure of the local condition. Let us remember that a patient whose hip joint is ankylosed in about 25° of flexion and a few degrees less of abduction, has a very useful lower limb, and that we should make this degree of final deformity our objective.

Fact Number Five.

Tuberculous disease of a joint is a destructive process and sooner or later sufficient products of destruction are formed to produce a collection of so-called tuberculous pus.

This collection of material is harmless, provided it remains uninvaded by pathogenic organisms. It should be left alone, unless it becomes of such a size or increases so rapidly as to be in danger of rupturing. It should be aspirated repeatedly if necessary, and Calot's fluid should be injected. If, in spite of aspiration, it cannot be controlled, it should be opened under the strictest aseptic precautions, emptied as far as possible without contaminating the skin edges, and closed at once.

A REPORT ON THE USE OF GAS ANÆSTHESIA, 1925-1930.

By GEOFFREY KAYE, M.D.
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THIS report includes two parts, namely: I. A statistical review of the use of nitrous oxide-oxygen

and ethylene-oxygen anæsthesia in a Melbourne metropolitan hospital, 1925-30, together with the percentage fatality rate under these anæsthetics. II. An inquiry into the circumstances of the individual fatalities.

PART I: STATISTICAL REVIEW.

The first administration of an anæsthetic gas (ethylene) in the Hospital occurred on December 10, 1924. Since that date, the popularity and scope of gas anæsthesia has increased most gratifyingly. The present report summarizes the results in routine major surgery between January 1, 1925, and December 31, 1930.

Number of Administrations.

Recorded administrations of anæsthetic gases total 1937, distributed as follows:

Nitrous oxide-oxygen	179
Ethylene-oxygen	1,733
Unspecified "gas-oxygen"	20
Nitrous oxide-ethylene-oxygen ...	5
Total	1,937

The relative popularity of nitrous oxide and of ethylene is obtainable from Table I.

TABLE I.

Relative Frequency of Employment of Nitrous Oxide and of Ethylene, 1925-30. Unsuccessful administrations are included.

Year.	Nitrous Oxide Cases.	Ethylene Cases.	Ratio, Ethylene : Nitrous Oxide.
1925	30	15	1·0 : 2
1926	46	81	1·8 : 1
1927	36	291	8·1 : 1
1928	15	385	25·7 : 1
1929	21	475	22·6 : 1
1930	31	486	15·7 : 1
Total	179	1,733	9·7 : 1

This table indicates: (i) a rapid and gratifying increase in the number of gas anæsthetics administered. (ii) An overwhelming preponderance in the number of ethylene administrations as compared with those of nitrous oxide.

The reasons for the limited use of nitrous oxide are: (i) the difficulty for the unaccustomed anæsthetist in keeping nitrous oxide anæsthesia within the relatively narrow optimal zone between consciousness on the one hand and anoxæmia on the other. This is a cardinal factor where, as here, anæsthetic gases are administered by relatively untrained house physicians. (ii) The slower change in anæsthetic level and slower elimination of ethylene, which facilitates successful administration by the semi-trained anæsthetist. (iii) The fact that the anæsthetic apparatus possessed by the hospital is better adapted to the use of ethylene than of nitrous oxide.

The series of cases is too small, nor are controls present, for any attempt to be made to assess the relative merits of ethylene and nitrous oxide. It is, however, probable that the year 1931 will show a revived interest in nitrous oxide anæsthesia. There have been no ethylene fires nor explosions.

Success of Administration.

Anæsthesia sufficient for the surgeon was obtained in 97·1% of administrations (both gases). The details are tabulated in Table II.

TABLE II.

Failures to obtain Satisfactory Anæsthesia, 1925-31. Ether anæsthesia by the open method was usually substituted. Thirteen cases of failure due to mechanical defect in the apparatus are omitted.

Gas.	Success.	Failed.	Percentage Failure.
Nitrous Oxide	173	6	3·4
Ethylene	1,673	48	2·9
Nitrous Oxide+Ethylene	4	1	(25)
Gas Unspecified	17	2	(11·8)
Total	1,867	57	2·9

The number of successful cases requiring ether supplement cannot be determined, but is probably greater than would be encountered in private practice. This is due to relative inexperience in technique and premedication, and to difficulties in coaptation of the masks supplied at the hospital.

There has been a steady decline in the failure rate from 4·3% (both gases) in 1925 to 2·3% in 1930. This is attributable to: (i) the increasing volume of work done by trained honorary anæsthetists; (ii) the rather unsystematic, but progressive, education of house physicians in gas anæsthetic technique.

Mortality Rate.

The average mortality rate (both gases), 1925-30, is 0·83%. This seems very great when compared with the average death rate for the hospital (major surgery, all anæsthetic agents, 1919-29) of 0·18%. It must be remembered that gas anæsthesia still remains in Australia the choice for the "poor risk" patient, and that the patient of "good anæsthetic risk" generally receives ether anæsthesia.

Details of the gas anæsthetic mortality are to be found in Table III.

TABLE III.

Gas-anæsthetic Mortality Rate. Unsuccessful administrations included, as having been exposed to the risk of induction with gas.

Gas.	Cases.	Deaths.	Deaths Percentage.
Nitrous Oxide	179	4	2·20
Ethylene	1,733	13	0·75
Nitrous Oxide+Ethylene	5	0	—
Gas Unspecified	20	0	—
Total	1,937	17	0·83

The mortality rate for ethylene has altered little since the first deaths in 1927, prior to which 96 administrations had been given. The nitrous oxide administrations are too few to admit of conclusions being drawn from them.

The deaths, as will be later apparent, all lie within the classes of patients who were most severely ill, mainly with acute abdominal conditions, extensive trauma or grave anæsthetic risk. The immediate mortality is nil amongst "good risk" patients, where handled, amongst septic states and thyreoid disorders.

An inquisition into the 17 fatal cases forms the second part of this report.

Gas Anæsthesia in Averting Operative Shock.

Unfortunately, it has not been hitherto customary in the Hospital to classify the anæsthetic risk. Some such system as the American, which recognises four

degrees of increasing risk (lettered respectively, "A" to "D") would have facilitated the preparation of this report. It is otherwise very difficult to reconstruct, from the records, the particular problem faced by the anæsthetist in any given case. It has therefore been attempted only to group the material under certain arbitrary and embracive headings: the alternative would have been to have employed almost as many classifications as there were patients.

The group wherein gas anæsthesia is held to have been given to avert operative shock includes *inter alia* operations upon old subjects, prostatic operations, operations of great severity upon otherwise healthy subjects, all abdominal sections ("B" risks), operations upon subjects of cardio-renal degeneration, and grave operations otherwise unclassifiable. The results are set out in Table IV.

TABLE IV.

Use of Gas Anæsthesia to Avert Operative Shock, with Mortality Rate in such Cases. Unsuccessful administrations are included.

Gas.	Cases.	Prophylactic against Shock.	Percentage Prophylactic.	Deaths.	Deaths Percentage.
Nitrous Oxide ..	179	43	(24·0)	3	(4·70)
Ethylene	1,733	814	47·0	3	0·36
Nitrous Oxide + Ethylene ..	5	4	(80·0)	0	—
Gas Unstated ..	20	9	(45·0)	0	—
Total	1,937	870	44·9	5	0·57

The increase in number of gas administrations to mitigate operative shock follows the general increase in total gas administrations, as surgeons and anæsthetists realize increasingly the value of gas anæsthesia. The death rate is not excessive, in view of the poor condition of many of these patients, and the deaths will be found to have occurred among the members of this wide group who were more severely ill.

Acute Abdominal Emergencies.

Gas anæsthesia has been administered to 260 patients with acute abdominal emergencies, many critically ill. There were 8 deaths, or 3·1% of the 260 patients. All these patients were desperately ill, and the mortality-rate is probably not excessive in relation to the nature of the work. Details are presented in Table V.

TABLE V.

Use of Gas Anæsthesia in Acute Abdominal Conditions, 1925-30, with Mortality Rate for such Cases. There were no unsuccessful administrations.

Gas.	Cases.	Deaths.	Deaths Percentage.
Nitrous Oxide	7	1	(14·3)
Ethylene	250	7	2·8
Gas Unspecified	3	0	—
Total	260	8	3·1

Acute abdominal conditions represent 13·4% of those requiring gas anæsthesia. As illustrating the growing popularity of the technique, gas was employed for but eight operations in 1925, for 70 in 1929, and for 56 in 1930.

Traumatic Shock.

Gas was administered to 94 patients suffering from traumatic shock, that is, to 4·8% of the total patients who received gas. There were two deaths, a mortality rate of 2·1% for the 94 administrations. In view of the severely traumatized condition of many of the patients, this figure is low. Details are set out in Table VI.

TABLE VI.

Use of Gas Anæsthesia in Traumatic Shock, 1925-30. Four unsuccessful ethylene administrations are omitted.

Gas.	Cases.	Deaths.	Deaths Percentage.
Nitrous Oxide	7	0	—
Ethylene	87	2	2·3
Total	94	2	2·1

There was but one anæsthetic administered to a patient suffering from traumatic shock in 1925, and three in 1926. In 1930, 28 such anæsthetics were administered, ethylene being employed in 26 of these cases.

Thyreoid Surgery.

Thyreoid surgery has represented 8·4% of the total administrations of gas anæsthesia. There were 163 cases, grouped thus:

Under nitrous oxide ...	74
Under ethylene	85
Gas not specified	4
Total	163

One unsuccessful nitrous oxide administration is omitted.

There were no fatalities at actual operation, a fact creditable to gas anæsthesia, as many patients were "poor risks." Ethylene was first used in 1926, but only exceeded nitrous oxide in frequency of use in 1928. The wide employment of nitrous oxide in thyreoid surgery is striking: nearly half of the total administrations of nitrous oxide come within this category. Data are wanting for any comparison of the respective advantages of nitrous oxide and of ethylene.

Sepsis and Toxæmia.

The sepsis and toxæmia group comprises such surgical conditions as severe cellulitis, septic gangrene, gas gangrene, carbuncle and juvenile osteomyelitis. Empyema, chronic adult bone sepsis, intraabdominal sepsis and septic abortion are classified elsewhere. There were 107 cases, representing 5·5% of the total administrations of gas anæsthesia, 1925-30. They were thus distributed:

Under nitrous oxide ...	7
Under ethylene	100
Total	107

Seven unsuccessful administrations are omitted. There were no fatalities, although many of the patients were gravely ill.

Respiratory Diseases.

The respiratory disease group includes empyema, pneumonia and bronchitis; also surgical procedures upon patients suffering from pulmonary tuberculosis, or who were suspected of pulmonary tuberculosis because of other tuberculous manifestations, for example, tuberculous peritonitis or arthritis, ischio-rectal abscess or epididymitis.

The respiratory cases numbered 137, or 7·1% of the total gas administrations, 1925-30. There was one fatality; an empyema patient died. The results are tabulated in Table VII.

TABLE VII.

Gas Anæsthesia in Respiratory Disease. Two unsuccessful administrations are omitted.

Gas.	Cases.	Deaths.	Deaths Percentage.
Nitrous Oxide	15	0	—
Ethylene	121	1	0·83
Gas Unspecified	1	0	—
Total	137	1	0·73

Primary Cardiac Disease.

Gas anæsthesia is rarely recorded as having been selected on account of the surgical patient suffering from cardiac disease *per se*. Many unhealthy hearts were encountered, for example, in patients for prostatectomy, but in each of these the cardiac condition did not wholly determine the choice of anæsthetic, and the patient was classified as, for example, "prevention of operative shock." In but 18 cases was the choice of gas anæsthesia determined by the cardiac lesion rather than by the nature of the proposed surgical procedures *et cetera*. The 18 cases represent 0·93% of the total administrations of gas anæsthesia, 1925-30. The results are shown in Table VIII.

TABLE VIII.

Gas Anæsthesia in Primary Cardiac Disease. No unsuccessful administrations.

Gas.	Cases.	Deaths.	Deaths Percentage.
Nitrous Oxide	1	1	(100)
Ethylene	17	—	—
Total	18	1	(5·5)

The one fatality occurred in a case of grave congenital *morbus cordis*. In view of the anæsthetic risk involved, the death rate for this small series is not great.

Diabetes Mellitus.

The gas anæsthetics, since they produce no acidosis, are well adapted to surgery in diabetic patients. However, but 17 administrations are recorded, or 0·88% of the gas administrations, 1925-30. Of the seventeen patients, one received nitrous oxide and sixteen ethylene. There were no unsuccessful administrations and no fatalities.

Diathermy and Cautery.

Nitrous oxide is well adapted to the use of diathermy and the cautery, yet was so employed in but three instances during the period 1925-30. There were no failures and no fatalities. The use of nitrous oxide may be well extended in the future for diathermy and cautery cases, to the exclusion of chloroform.

"Good-Risk" Patients.

The anæsthetic gases were administered to 227 "good risk" patients in the period 1925-30, that is, to 11·7% of the total gas anæsthesia patients for this period.

The group includes: (i) Short or minor operations, for example, for hæmorrhoids, herniotomy, incision of small abscesses, presumably to mitigate after-sickness. (ii) Cases, other than abdominal sections, in which the patient seemed healthy, and in which no indication existed for gas anæsthesia on the score of anæsthetic risk. (iii) Breast surgery, with simple removal of the breast or of a neoplasm in young and healthy subjects. Unfavourable cases, and radical operations, are listed under "prevention of operative shock." (iv) Cases in which gas anæsthesia was apparently employed to improve the anæsthetist's technique.

The day must come when gas anæsthesia will be available (as in America) to all patients, and not only to those of lowered anæsthetic tolerance.

The 227 "good risk" patients are grouped in Table IX.

TABLE IX.

Gas Anæsthesia in "Good Risk" Patients. Six unsuccessful ethylene administrations are included.

Gas.	Cases.	"Good Risks."	"Good Risks" Percentage.
Nitrous Oxide	179	21	(11·7)
Ethylene	1,733	203	11·7
Ethylene + Nitrous Oxide	5	0	—
Gas Unspecified	20	3	(15·0)
Total	1,937	227	11·7

There were no fatalities, as might be expected when the safest of inhalational anæsthetic agents were administered to "A" risk patients.

Endotracheal Gas Anæsthesia.

Ethylene has been administered by the endotracheal method 34 times in the period 1925-30. Endotracheal administration of nitrous oxide, which is technically more difficult, has been apparently not attempted. The cases may be grouped thus:

Thyreoid surgery	1
Prevention of shock	15
Respiratory disease	1
"Good risk" patients	14
Total	31

There were three unsuccessful administrations (one being due to mechanical causes) and no fatalities.

PART II: DETAILS OF ANÆSTHETIC FATALITIES.

Anæsthetic risk is classified in accordance with careful consideration of the patient's anæsthetic tolerance in general and in particular, of the nature of the proposed operation, and of the characteristics of the anæsthetic agent to be employed. We can

TABLE X.

*Deaths under Nitrous Oxide and Ethylene, 1925-30.**

No.	Diagnosis and Attempted Operation.	Age.	Sex.	Anæsthetic Agent.	Clinical Condition.	Heart.	Urine.	Pulse.	Temperature Fahrenheit.	Resp	Blood Pressure in mm. of Mercury.	Died.	Inquest.	Autopsy.	Comment.
1	General peritonitis and subphrenic abscess after septic abortion. Drainage.	19	F.	Nitrous oxide.	Moribund.	No abnormal signs.	Albumin.	144	101·2°	32	?	During operation.	+	Large subphrenic and pelvic abscesses. General peritonitis. Heart, vessels, lungs and kidneys normal.	Desperate anæsthetic "risk."
2	Œsophageal stricture. Starvation, six weeks. Gastrostomy.	67	M.	Nitrous oxide.	Moribund.	Weak heart sounds.	?	100	97·0°	28	80	During operation.	—	Not performed.	Desperate anæsthetic "risk."
3	Cancerous stricture sigmoid. Successful cæcostomy. Second stage excision of growth.	72	M.	Nitrous oxide.	Very low.	Extrasystoles.	Normal.	64	97·6°	?	?	During operation.	+	Colostomy. Myocardial fibrosis. Coronaries sclerosed. Pericardial adhesions. Lungs congested; old tuberculosis scars, right. Ring carcinoma sigmoid.	Bad anæsthetic "risk."
4	Pneumonia: double empyema. Thoracotomy.	52	F.	Ethylene.	Grave: dyspnœic.	P_2+: No abnormal signs.	Normal.	128	102·0°	48	?	During operation.	—	Double empyema; pleuritic adhesions, left. Heart, lungs, kidneys normal.	Bad anæsthetic "risk."
5	Multiple fractures legs: shock and hæmorrhage. Amputation foot.	42	M.	Ethylene.	Gravely shocked.	No abnormal signs.	?	130	96·6°	20	130	End of operation.	+	Not performed.	Bad "risk." Injuries may have necessitated operation whilst still shocked.
6	Duodenal ulcer with hæmatemesis. Blood transfusion given. Gastro-enterostomy.	37	M.	Ethylene.	Grave: much exsanguinated.	No abnormal signs.	Normal.	80	98·0°	30	110	During operation.	—	Anæmia. Congestion and œdema lungs. Duodenal ulcer; no bleeding into bowel. Heart, vessels, liver, kidneys normal.	Bad "risk." Postponement of operation (if possible) might have been safer.
7	General peritonitis, (?) perforated appendix. Laparotomy: drainage.	75	M.	Ethylene.	Very toxic.	No abnormal signs.	Normal.	112	97·4°	28	90	End of operation.	—	Not performed.	Very bad anæsthetic "risk."
8	Compound fracture femur six hours before, when drunk. Excision, reduction, suture.	19	M.	Ethylene.	Shocked despite saline transfusion.	No abnormal signs.	?	94	98·0°	20	110	During operation.	+	Not performed.	Bad "risk," though had been given time to recover from shock.
9	Pyelonephrosis after hysterectomy. Lumbar nephrostomy.	35	F.	Ethylene.	*In extremis.*	No abnormal signs.	?	108	97·0°	24	?	End of operation.	—	Both kidneys disorganized and full of pus, especially right. Occluded, dilated right ureter. Cystitis. Heart, vessels, liver normal.	Desperate anæsthetic "risk."
10	Salpingitis: early general peritonitis. Laparotomy.	31	F.	Ethylene.	Very toxic.	No abnormal signs.	Albumin.	132	100·8°	28	?	During operation.	—	Gut distended, with peritonitis and lymph exudate. Ruptured right pyosalpinx. Liver, kidneys toxic. Heart normal.	Very bad "risk."
11	Perforated gastric ulcer. Closure.	39	M.	Ethylene.	Grave.	No abnormal signs.	?	168	96·0°	56	?	During operation.	—	Perforated duodenal ulcer. General peritonitis; lymph exudate and purulent fluid. Liver softened, lungs congested. Heart normal.	Very bad "risk."

*Owing to the rapid elimination of the gas anæsthetics, only those patients are included who died upon the operating table, or before leaving the operating theatre.

TABLE X.—*Continued.*

Deaths under Nitrous Oxide and Ethylene, 1925-30.*—*Continued.*

No.	Diagnosis and Attempted Operation.	Age.	Sex.	Anæsthetic Agent.	Clinical Condition.	Heart.	Urine.	Pulse.	Temperature Fahrenheit.	Resp.	Blood Pressure in mm. of Mercury.	Died.	Inquest.	Autopsy.	Comment.
12	Positional contractures; talipes. Rectification.	12	F.	Nitrous oxide.	Cyanosed. Clubbed fingers.	Congenital pulmonary atenosis. E.C.G. of right prepond.	Albumin.	100	97·6°	?	110	During operation.	—	Right heart hypertrophied. Patent septum and *foramen ovale*. Valves clear. Lungs and brain congested.	Desperate "risk."
13	General peritonitis, perforated appendix. Drainage.	32	F.	Ethylene.	Very grave.	Left heart enlarged. Sounds weak.	Albumin.	132	101·0°	32	?	During operation.	—	Ruptured appendix. Abdomen full of pus from perforation. Liver. General peritonitis. Heart, lungs, kidneys normal.	Very bad anæsthetic "risk."
14	Traumatic rupture of jejunum. Sutured at previous operation. Hernia of gut five days later. Replacement.	21	M.	Ethylene.	Grave.	No abnormal signs.	Normal.	?	?	?	?	During operation.	+	Not performed.	Bad "risk."
15	Cholelithiasis: acute cholecystitis. Cholecystectomy.	70	M.	Ethylene.	Poor "risk."	Vessels sclerosed. Heart signs normal.	Diastase 230+: else normal.	?	?	?	?	During operation.	—	Acute cholecystitis without stone; hemorrhagic pancreatitis. Liver toxic. Chronic nephritis. Heart dilated; atheroma. Lungs congested.	Very bad anæsthetic "risk."
16	Carcinoma colon; chronic intestinal obstruction. Caecostomy.	75	M.	Ethylene.	Low.	No abnormal signs.	?	88	97·6°	24	?	End of operation.	—	Annular carcinoma colon; almost total obstruction. Toxic degeneration myocardium. Marked atheroma abdominal aorta.	Bad "risk."
17	Bilateral renal neoplasm. Removal of diagnosed kidney, that of other side not being clinically apparent.	47	M.	Ethylene.	Very grave. "Air-hunger." Vomiting. Blood sugar, 0·12%.	No abnormal signs.	Acetone.	92	97·0°	32	?	End of operation.	—	Bilateral renal pyonephrosis and calculi; parenchyma almost destroyed. Bilateral pulmonary tuberculosis; pleuritic adhesions. Heart dilated. Liver congested.	Very bad anæsthetic "risk."

*Owing to the rapid elimination of the gas anæsthetics, only those patients are included who died upon the operating table, or before leaving the operating theatre.

decide upon the relative safety of a given anæsthetic agent in a given type of operation only after it has been administered to a large number of patients subjected to that operation, grouped into classes of equal number but of different anæsthetic risk. No statistics worked out on this basis are known to the present writer.

Hence, the anæsthetic death rate for various anæsthetic agents is diversely stated in the literature. Such statistics possess little real value, because care is not taken to express the death-rate in terms of the condition of the patient and the nature of the operation. It is a more hazardous thing to administer a given anæsthetic agent to a series of patients suffering from general peritonitis, than to an equal number of patients suffering from inguinal hernia.

Thus, we read that the mortality rate for chloroform is one in 4,000, for ether one in 16,000 and for nitrous oxide perhaps one in 500,000.[1] For reasons above mentioned, these figures can have little scientific value. Indeed, the gas-anæsthetic mortality rate for the Hospital (0·83%) is very far removed from these "ideal" figures. The reason will be apparent after consideration of Table X, wherein the details of the 17 gas anæsthetic deaths are tabulated. All the 17 patients were extremely bad "anæsthetic risks."

Details of 107 anæsthetic fatalities occurring in the Melbourne metropolitan area, 1919-29, were published in this journal in 1930.[2] This series included but five deaths under nitrous oxide and none under ethylene anæsthesia. It is therefore profitable to compare the conclusions drawn from the 17 fatalities of the present report with those drawn from the earlier and larger series of fatalities.

The 107 fatal cases reported in 1930 had been subject to inquest by the City Coroner of Melbourne. The 17 cases of the present series, though reported to the Coroner, were rarely subjected to inquest; it being the Coroner's custom to hold no inquest upon clear-cut cases wherein no advantage would result.

The elimination of the gas-anæsthetics being so rapid, it was thought desirable to include in the present series only those patients who died whilst actually under the anæsthetic, or before removal from the operating theatre.

The following points become apparent in considering the deaths under gas anæsthesia:

1. All the 17 gas anæsthesia patients were very bad "anæsthetic risks," some, indeed, being desperate "risks."

2. Local anæsthesia being excepted, the choice of anæsthetic agent was in each case apparently the best possible.

3. No death was directly preventible, nor associated with such errors in technique as neglect of airways, aspiration of vomitus *et cetera*.

4. The pathological condition was, in every instance, serious. It may be summarized thus:

	Cases.
Œsophageal stricture, starvation ..	1
Primary cardiac disease	1
Acute pancreatitis	1
Double empyema	1
Intraabdominal malignant disease ...	2
Pyonephrosis	2
Shock and hæmorrhage	4
Intraabdominal sepsis	5
	17

It is noteworthy that no case presented at autopsy a verdict of "no organic lesion to account for death." This dubious finding occurred in no less than 10% of the 107 fatalities, 1919-29.

5. The mortality-rate (0·83% for 1,937 gas administrations, 1925-30) is probably not excessive under the circumstances.

6. These considerations, together with the statistics advanced in the first section of this report, are held to support the claim that the gas anæsthetics should be preferred above other inhalational drugs in cases of bad "anæsthetic risk."

Acknowledgement.

Thanks are due to the Coroner of the City of Melbourne for his courtesy in making available the official depositions and *post mortem* findings, and to the officers of his court for their ready assistance.

REFERENCES.

(1) W. Bourne and J. W. Duncan: "Nitrous Oxide Analgesia and Anæsthesia in Obstetrics," *Canadian Medical Association Journal*, November 1921.
(2) G. Kaye: "Pathological Findings in Deaths during Anæsthesia," THE MEDICAL JOURNAL OF AUSTRALIA, 1930, Volume I, page 66.

EXTRARENAL FACTORS IN DIURESIS.[1]

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WITHIN the closed system of the organism in which the life process is carried on in aqueous solution, it is scarcely a matter for surprise that our present and rapidly extending knowledge of the hormones should disclose the fact that scarcely one of them is without effect upon the water metabolism.

Among the better known in this connexion are the thyreoid and pituitary hormones; those formed by the liver and pancreas are not yet sufficiently investigated. Since the hormones are physiological regulators, it is to be anticipated that study of their mode of action in the normal animal will be beset with difficulty, since they manifest their action more particularly when the normal processes are disturbed.(1) The term "water metabolism" encompasses the intake, distribution and transport, and excretion of water, so that a study of this kind includes influences affecting the resorption of water from the gut, the retention of fluid by blood proteins or by tissues, the loss of water by the lungs or skin, as well as the kidney diuresis.

The first sign of thyreoid deficiency to attract attention was the condition known as myxœdema which followed upon total extirpation of the thyreoid gland. This condition is associated with a retention of water in the tissues and a diminution of the water excretion. Contrasted with this is the result of over-action of the thyreoid gland as seen in typical *morbus Basedowi*, where there is increased excretion of water and diminution in the amount held by the tissues. In the clinic it is now widely known that in many instances thyreoid preparations will produce a remarkable diuresis where other and more powerful diuretics, *per se*, have no effect. The point at which the thyreoid hormone influences the cycle of water metabolism would appear to be that of water balance between tissue and blood. Eppinger(2) showed by application of the intradermal normal saline blister technique, both in animals after thyreoidectomy and on the human subject, that the absorption rate of saline was reduced in myxœdema and increased in hyperthyreoidism as compared with the normal. Further evidence for the extrarenal action of thyreoid preparations is given by the subcutaneous injection of thyroxin. The diuresis which follows the injection can be stopped by the simultaneous injection of a cubic centimetre of hypertonic glucose solution, which holds up the tissue fluid set free by the thyroxin and prevents its reaching the blood stream.

As shown early in the investigation of the hormone from the posterior lobe of the pituitary body, a powerful influence on diuresis can be produced by the injection of the hormone into the intact animal. In the laboratory animal the evidence has been so conflicting as to give rise to a literature of its own, some observers reporting a diuretic effect and others reporting an antidiuretic effect. In addition Starling and Verney have shown that pituitary extract causes the isolated kidney, perfused by a heart and lung preparation, to store up sodium chloride. The typical antidiuretic action is seen only when a diuresis of abnormal extent is in progress and is seen clinically in *diabetes insipidus* or in artificially produced diuresis from the ingestion of an excess of water. The conflict arises owing to the action of the hormone on other tissues simultaneously. In a rabbit which has received an infusion of fifty cubic centimetres of normal saline solution, injection of the hormone produces at first a fleeting cessation of urinary flow due to spasmodic ureteral contraction;(3) this is

[1] Read at a meeting of the Medical Sciences Club of South Australia on May 1, 1931.

followed by an increased flow which appears to be due to the rise of blood pressure induced by the effect of the hormone on the vessel walls. That this rise in blood pressure cannot be entirely due to increased renal circulation (the renal vessels being unconstricted) is shown by a second injection of extract which causes again a diuresis, the accompanying change in blood pressure being much smaller.[4] If the animal is watched, however, this diuresis passes off and is replaced by a prolonged cessation of urinary flow—the antidiuretic phase. The presence of an excess of water in the circulating blood is necessary in order that the last result may be produced.

The older idea of the point of action of the pituitary hormone emphasized the renal influence, while modern workers would rather consider that it acts on the tissue-blood water balance in the opposite sense to the action of thyroxin, and that there may be a renal effect in the manner indicated by Starling and Verney[5] notwithstanding. Injection of pituitary extract in a totally nephrectomized animal causes water to pass from blood to tissues (that is, muscle, liver *et cetera*), while recently Heller[6] has shown that pituitrin added to water in which frogs are kept, leads to an imbibition swelling of the whole animal.

Since the main evidence for any renal action is that of the perfused isolated kidney, one may be justified in considering that in the intact organism the main effect of the hormone is upon the tissue imbibition factor, the other effects being secondary to mechanical and vascular changes. The conflicting results of different investigators may be explained as being due to the prevailing direction of exchange of water (that is, from tissue to blood or from blood to tissue) at the time of the experiment, the hormone influencing the one direction more than the other.

Quite recently it has been shown by Kiss[7] that if an intracutaneous blister of normal saline solution be produced on top of a subcutaneous pituitrin injection, there are two effects, according to whether there is liver stasis present or not. If liver stasis is present, the absorption time of the blister is not affected; if it is not, the absorption time is markedly reduced. The same result follows intramuscular injection of pituitary hormone. That the capillary effect is small is shown by the fact that even where no capillary blanching occurs, the absorption time is not hastened in liver stasis, therefore it is a tissue effect. This conclusion has been supported by the fact that fluoresceine injected into the blister reaches the veins only after four minutes in liver œdema cases, while non-œdematous controls require two minutes, that is, the shortest time of dye passage is observed in cases with longest duration of saline blister. With stasis and pituitrin, tissues rapidly take up and slowly yield fluid; normally the tissues take up little and rapidly pass it out.

In this connexion the separation of at least two principles, an oxytocic and a pressor, in the pituitary hormone by Dudley[8] and by Kamm[9] is of considerable importance; the third principle is the frog melanophore stimulant, which was discovered by Dreyer and Clark.[10] At present, the diuretic property is known to reside in the pressor fraction, and is otherwise not separately identified. The other two fractions are without influence upon the water metabolism. Although the higher cost of the separated pressor principle has made it so far valuable only for research purposes, the discovery of the endonasal method of application of pituitary extract, either as a spray or in the form of snuff (Porges and Adlersberg[11]) has been an important advance in the treatment of *diabetes insipidus*. In strong contrast with the action of the posterior pituitary hormone is that of the anterior lobe of the pituitary gland. Since the pure preparation has been isolated, it has been shown to produce polydipsia and polyuria and increased salivary secretion, with, in the female, increase of milk secretion. The antidiuretic action previously reported appears to be due to contamination with extract from the posterior lobe.

While so much is known concerning the action of thyreoid and pituitary hormones upon the water metabolism, little is known concerning the part played by the liver in this connexion. Standing as it does, in the direct path of water intake to the body, it would be a matter for surprise were it without effect upon the water metabolism. It was shown in 1900 by Thomson[12] that the intravenous injection of water amounting to one-third of the blood volume, produced no diuresis; and Ginsberg and Cow showed that the output of water after subcutaneous injection was small, while, given by the alimentary canal, the diuresis was rapid. In 1923 Molitor, and Pick [13] demonstrated that in the dog with an Eck fistula, the diuresis after peroral administration of water was considerably delayed by comparison with the normal animal, and stated their conviction that the liver played an important rôle, either by its mechanical effect on the portal circulation or by hormonal influence. Hicks and Mitchell,[14] in 1926, were able to produce a prolonged polyuria in rats, and demonstrated that the liver was enormously enlarged in those animals which were producing the greatest urinary flow, while the kidneys remained unaltered by the excessive filtration stress to which they were subjected. It has been shown by the Vienna school that total extirpation of the liver from the frog, which survives the operation for some time, leads to an absorption of water by the tissues reaching 45% of the body weight in five days. Controls with liver *in situ*, but with efferent vessels ligated, showed no change at the end of the same period.

For some time there has been clinical belief in a "liver œdema" (Hannot), and Wagner and Pick[15] demonstrated such œdema coupled with deficient urinary secretion in a case of amyloid disease of the liver in which there was no interference with the portal circulation which could be held responsible. The Vienna school has isolated an actively diuretic

preparation from the liver after much difficulty in separating it from other actively antidiuretic substances. As pointed out by Molitor, it is just the antidiuretic substance that might be expected to be first discovered in the liver of a normal healthy animal, as this is the most likely one to be called upon to function; but with improved technique a substance has been isolated, still in the impure state, which has had the effect of removing the uræmic symptoms in the laboratory animal with artificially reduced kidney efficiency. The continued injection of minute doses of the preparation maintained the diuresis in such cases. There is thus for the first time direct evidence of a hormonal influence of the liver upon diuresis, and we begin to see the reason for some of the facts previously cited as bearing upon this problem.

Adrenalin, as the hormonal adjunct to the sympathetic system, influences the water metabolism at many points. In man and in animals its injection is followed by a reduction in urinary secretion and also in sodium chloride output, partly resulting from vascular constriction in the kidney and partly owing to water retention in the muscles. Recently Eppinger and Hess, and Falta have shown that in cases where there is a special sensibility to adrenalin action, there follows upon injection a rapid diuresis, with, however, the usual diminution in sodium chloride excretion. Insulin has been shown by Koref and Mautner[16] to increase resorption of water from the intestine, and it produces also a retention of water in the musculature, a fact which is responsible for the rapid increase in body weight during the insulin-mast cure. On account of this, insulin administration leads usually to a diminution of urinary secretion, while, when the contrary occurs, the explanation is to be sought in the existing imbibition pressure in the tissues—a factor previously discussed when dealing with the contradictory results obtained with pituitary extract. So far as parathyreoid hormone is concerned (its effect being to raise the blood calcium), there is a fall in tissue imbibition pressure and a loss of water, the reverse being the case in parathyreoprival tetany.

The various hormones have thus an effect operating in one of two ways upon the water metabolism: the one leads to increased imbibition pressure or tissue retention of water and diminution of diuresis; the other operates in the reverse manner. Since the internal secreting glands are under the influence of the nervous system, either directly or through the medium of hormones from glands directly influenced, it is not a great step to develop a conception of nervous control of water metabolism. It can readily be demonstrated that the effect of thyroxin on diuresis is prevented by administration of ergotoxin, which paralyses sympathetic augmentors; while the antidiuretic effect of pituitrin can be counteracted by central narcosis. Clinically there is parallel evidence; thyroxin-resistant cases have been demonstrated by Falta, while Hoff and Werner have likewise found pituitrin resistant cases in certain mid-brain disorders. Adlersberg and Porges have similarly segregated a type of *diabetes insipidus* which has a syphilitic ætiology and is similarly resistant to pituitary extract. Pick and his coworkers[17] have shown that medullary anæsthetics reduce diuresis; and recently Hicks and Smirk,[18] in Pick's laboratory, have shown that diuresis diminution produced by chloretone is accompanied by a concentration of the blood.

We may conceive this resistance to hormone action as being due to disorder of the centre, so that the stimulus is without effect, or we may consider with Pick in terms of his Harvey Lecture, that whether the hormone acts centrally or peripherally, there can be no response at the periphery unless the "end organ" is in a condition of *Reaktionsbereitschaft* or susceptibility. By this new conception evidence for and against either central or peripheral effects are reconciled, and the pharmacological principle of a reagent having more than one point of action can be applied to these hormones without disturbing the conception of a central regulation.

As an example, the water mobilizing effect of thyroxin is in abeyance if the tissues contain no freely movable water, while pituitrin will be without effect unless there is a flow of water from the tissues. According to Pick,[19] the effective stimulus for the water regulating centre is the existing water content of the blood. Hydræmia is thus the central point of the water metabolism cycle and is conceived under this scheme as acting, not through physico-chemical adjustment, but by means of its quite specific stimulus to a nervous centre. As in many similar fields of controversy, the adoption of a middle course may be necessary, and at the moment we are investigating in the Pharmacology Department the effect of altering both the purely physico-chemical and the hormonal factors. The work of Andrews[20] upon the effect of hydrogen ion concentration upon the tissue imbibition is being critically repeated as a first step in that direction.

References.

(1) H. Molitor: *"Hormone und Wasserhaushalt," Wiener Medizinische Wochenschrift*, Volume LXXX, March 22, 1930, page 430; March 29, 1930, page 466.
(2) H. Eppinger: Personal demonstration.
(3) W. G. Mackersie: "The Diuretic and Anti-Diuretic Effect of Pituitary and Suggestions for a Subsidiary Test," *Journal of Pharmacology and Experimental Therapeutics*, Volume XXIV, 1924, page 83.
(4) E. A. Schäfer and P. T. Herring: "The Action of Pituitary Extract upon the Kidney," *Philosophical Transactions of the Royal Society*, Volume CXCIX, 1908, page 1.
(5) E. Starling and E. B. Verney: "The Secretion of Urine as Studied on the Isolated Kidney," *Proceedings of the Royal Society of London*, Volume XCVII, 1925, page 321.
(6) J. Heller: *"Uber die Einwirkung von Hypophysenhinterlappen-extracten auf den Wasserhaushalt des Frosches," Archiv für Experimentelle Pathologie und Pharmakologie*, Volume CLVII, 1930, page 298.
(7) A. Kiss: *"Über örtlich beschränkte Wirkung von Hormonen, speziell des Pituitrins auf den Wasserwechsel," Klinische Wochenschrift*, Volume X, January 24, 1931, page 162.
(8) H. W. Dudley: "Some Observations on the Active Principes of the Pituitary Gland," *Journal of Pharmacology and Experimental Therapeutics*, Volume XIV, 1919, page 295.
(9) Kamm, Aldrich, Grote, Rowe and Bugbee: "Active Principles of the Posterior Lobe of the Pituitary Gland," *Journal of the American Chemical Society*, Volume L, 1928, page 573.
(10) N. B. Dreyer and A. J. Clark: "The Active Principles of Extracts of the Posterior Lobe of the Pituitary," *Journal of Physiology*, Volume LVIII, 1924, page 18.

(11) D. Adlersberg and O. Porges: *"Uber die Behandlung des Diabetes Insipidus mit Pituitrin-Schnupfpulver," Wiener Klinische Wochenschrift*, Volume XLI, 1928, page 1467.
(12) W. H. Thompson: "Diuretic Effects of Sodium Chloride Solutions: An Enquiry into the Relation which Certain Factors Bear to Renal Activity," *Journal of Physiology*, Volume XXV, 1900, page 487.
(13) H. Molitor and E. P. Pick: *"Die Bedeutung der Leber für die Diurese," Archiv für Experimentelle Pathologie und Pharmakologie*, Volume XCVII, 1923, page 317.
(14) C. S. Hicks and M. L. Mitchell: "The Effect of a Continued Polyuria on the Kidneys of the Rat," *Australian Journal of Experimental Biology and Medical Science*, Volume III, 1926, page 221.
(15) E. P. Pick and R. Wagner: *"Uber die Hormonale Wirkung der Leber auf die Diurese," Wiener Medizinische Wochenschrift*, Volume LXXIII, 1923, page 695.
(16) O. Koref and H. Mautner: *"Uber die Wirkung des Insulins und des Pituitrins auf den Wasserhaushalt," Archiv für Experimentelle Pathologie und Pharmakologie*, Volume CXIII, 1926, page 151.
(17) H. Molitor and E. P. Pick: *"Uber zentral Regulation des Wasserwechsels. IV. Mitteilung: Die Aufhebung der diuretischen Coffein—und Theobrominwirkung durch Zwischenhirnnarkose," Biochemisches Zeitschrift*, Volume CLXXXVI, 1927, page 130.
(18) C. S. Hicks and F. H. Smirk: *"Die Beziehung zwischen Diurese und Blutkonzentration unter dem Einfluss von Chloreton und Morphin," Archiv für Experimentelle Pathologie und Pharmakologie*, Volume CLVI, 1930, page 135.
(19) E. P. Pick: "Regulation of Water Metabolism," "Harvey Lectures, 1929-30," 1931, page 25.
(20) E. Andrews: "Water Metabolism," *Archives of Internal Medicine*, Volume XXXVII, 1926, page 559.

SATURNINE RENAL DWARFISM.

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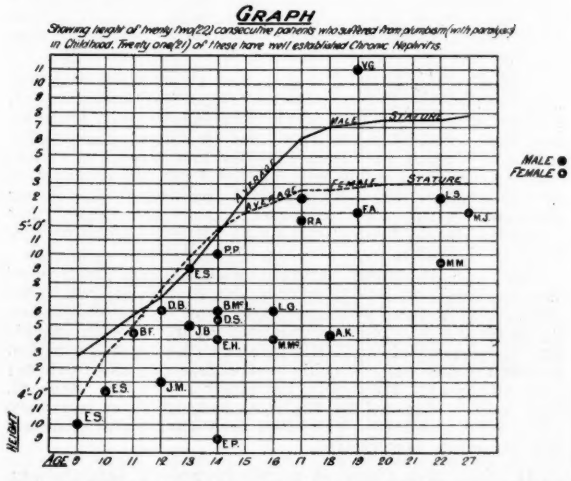
THE study of cases of juvenile lead nephritis in Queensland reveals the frequent occurrence of dwarfism, the extent of which appears to parallel the degree of plumbism in their childhood.

The accompanying graph, comparing a normal average height—age curve (Australian Mutual Provident Society standard)—with the height of twenty-two consecutive patients who had severe plumbism (with paralysis) in childhood, verifies this statement very clearly.



It is interesting to note that all of these patients are nail-biters. It was this constant association of nail-biting with infantile plumbism which led Gibson[1] to the conclusion that these children become poisoned by handling the veranda railings on which the lead paint has been rendered dry and powdery by the action of the tropical sun. This powdered lead carbonate adheres to the moist fingers and is then being constantly conveyed to the mouth on account of this habit.

Although it is well known that many chronic diseases are associated with dwarfism, the constant finding of dwarfing associated with chronic lead poisoning in children does not appear to have been stressed in the literature on this subject.

The occurrence of chronic nephritis in early adult life resulting from chronic plumbism in childhood is still doubted by some physicians, but when the life history of many of these unfortunate children is carefully followed up, there appears to be no possible room for doubt in this respect.[2][3] A condition known as renal infantilism has been described by many authors, and the question arises, therefore, as to whether it is the renal factor or some other toxic effect of lead which is responsible for this growth inhibition.

So-called renal infantilism has three main characteristics: (i) Chronic nephritis of the interstitial variety or congenital polycystic disease, (ii) stunted growth, usually with infantilism, (iii) changes in the bones similar to those of rickets.

The typical case of renal infantilism, or renal rickets as it is now more frequently called, has, according to Ashcroft,[4] a definite clinical picture. The urine shows the characteristic findings of chronic interstitial nephritis with polyuria, low specific gravity and small amount of albumin with hyaline and granular casts, but there is no cardiovascular disease, the blood pressure being usually below normal and the heart showing no sign of hypertrophy. The bony changes, which simulate those of rickets, are most marked in the long bones. *Genu valgum* is the commonest deformity, but all types of curves are found and the costo-chondral junctions are usually enlarged.

The term infantilism is frequently used for these cases, as most patients have delayed or absent secondary sexual characteristics, while their mentality is usually subnormal.

The only similarity between patients with renal rickets and our saturnine renal dwarfs is that they are both dwarfed in stature and have chronic interstitial nephritis, but the patients whose condition is due to lead, have, in addition, all the signs of generalized vascular sclerosis with raised blood pressure and cardiac hypertrophy, while in renal rickets the absence of hypertension is a characteristic feature. The term infantilism is not applicable to most of our patients, for their mentality and their secondary sexual characteristics are usually quite normal. Many of the females marry early in life, and the first indication of any disability is the sudden onset of eclampsia in their first pregnancy. In some few of the more severe cases of plumbism the mentality is definitely subnormal and the secondary sex characteristics are deficient, but this is the exception rather than the rule. There

also appears to be some variation in this respect with regard to renal rickets, as some authors[5] describe cases of this disease in which neural and genital growth are quite normal.

In the saturnine patients there are no gross bony changes; in some there is thickening at the costochondral junctions, which is possibly associated with the period of malnutrition during the acute phases of plumbism in their childhood. It is assumed that the failure of growth with retention of childish proportions is due mainly to delay or arrest of development of the cartilaginous zones. It is not due to early closure of the epiphyses as in some types of dwarfing.

Park and associates[6] have shown that, when taken for a sufficiently long period in sufficient doses, lead can produce changes in the forming bone which are reflected in the skiagrams as shadows of increased density. Since only the bone in process of growth is affected, they inferred that the lead either enters into the chemical composition of the bone or influences cellular activity in such a way that the character of the bone formed becomes altered. Such markings are probably not due to the deposition of lead, as they occur in other toxic states. Harris[7] and Elliott Smith[8] have shown that growing bone is very susceptible to nociceptive influences, and have demonstrated these characteristic "lines of arrested growth" in cases of diabetes and in the exanthems. The transverse striæ are most pronounced in the bones adjoining monoaxial joints.

The name dystrophic infantilism was coined by Brissaud[9] to describe those cases which appear to be secondary to toxic or infectious factors as contrasted with cases of endocrine origin. He describes infantilism developing in the child of a parent suffering from lead or mercury poisoning. Failure of proper development with resulting infantilism may be noted in some children with congenital syphilis or those who have suffered from infancy with chronic diseases such as tuberculosis, pellagra or cœliac disease. In North Queensland the subjects of chronic hookworm disease were frequently found to be dwarfed. These cases of dystrophic infantilism might be described as secondary infantilism, because it is assumed to be due to preexisting disease in contradistinction to the infantilism of endocrine origin; nevertheless, it is quite possible that these toxic conditions may also produce their results through their action on the endocrine system.

Case Histories.

The following illustrated cases tend to show the close pathological relationship between nephritic dwarfs with a definite history of lead poisoning and many cases of nephritis commonly seen in Queensland. In the latter there may be no history of previous lead poisoning, but they are nail-biters and have the identical clinical picture which we associate with plumbism, suggesting that they also have had previous unrecognized chronic lead poisoning.

CASE I.—J.B., aged thirteen years, whose height was 132·5 centimetres (four feet five inches) and whose weight was 29·9 kilograms (four stone ten and a half pounds), was a nail-biter and spent his childhood in a wooden house with dry paint on the veranda walls and railings. At the age of about two years he suffered from gastritis and abdominal pains, which lasted for about twelve months. His condition was diagnosed as plumbism, and he had had bilateral foot-drop for two periods of three months when two years and seven years of age. His other previous illnesses included measles and whooping cough. His mother and father are healthy. There is only one other child, who is not a nail-biter and is quite well.

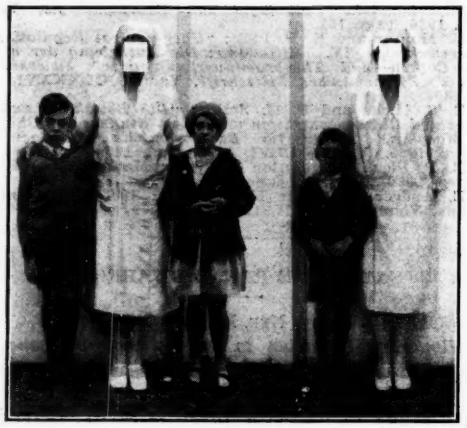


FIGURE I.
Patients A, B and C are the patients in Cases I, II and III.

The systolic blood pressure was 130 millimetres of mercury and his diastolic pressure 85 millimetres. The vessels showed early signs of thickening. The hæmoglobin value was 80%; the red cells numbered 4,100,000 per cubic millimetre. The colour index was 1·0. The Wassermann test yielded no reaction. The figures obtained by the urea concentration test were 1·9%, 2·0% and 2·1%. The blood urea was 65 milligrammes per 100 cubic centimetres. Mosenthal's test revealed albumin in four out of seven specimens with specific gravity ranging from 1·004 to 1·018. Hyaline and granular casts were present in the urine.

CASE II.—The patient, a girl, was sixteen years of age. Her height was 130 centimetres (four feet four inches), her weight was 30·6 kilograms (four stone twelve pounds). She was a nail-biter and spent her childhood in a wooden house, the paint on which was dry and powdery. When three years of age she had suffered from severe gastritis and lead poisoning, with bilateral foot-drop. The father and mother are well preserved; there are three other members in the family; these are all not nail-biters and have good health.

The systolic blood pressure was 118 millimetres of mercury and the diastolic pressure 76 millimetres. The Wassermann test gave no reaction. Mosenthal's test revealed albumin in each specimen of urine, with specific gravity varying from 1·012 to 1·020, the quantity passed during the day was 540 cubic centimetres (eighteen ounces) and the night 360 cubic centimetres (twelve ounces). The figures obtained by the urea concentration test were 0·8%, 1·2% and 1·7%. The blood urea was 52 milligrammes per 100 cubic centimetres.

In this case there is some degree of infantilism. The patient is mentally subnormal and, although the breasts are moderately developed, she has never menstruated.

CASE III.—J.M. is aged twelve years. His height is 147·5 centimetres (four feet eleven inches), his weight 25·1

kilograms (three stone thirteen pounds). The mother and father are both healthy and there are two other children in the family; they are not nail-biters and are both well, although they all lived in a wooden house with dry, powdery paint on the veranda walls and railings.

When about two years of age the patient suffered from gastritis with pains in legs; he then developed paresis of both legs with foot-drop, which is still present. His other illnesses include measles and whooping cough. The systolic blood pressure was 130 millimetres of mercury and the diastolic pressure 75 millimetres. The Wassermann test gave no reaction. Mosenthal's test showed albumin in five specimens, the specific gravity ranging from 1·015 to 1·020. The figures obtained by the urea concentration test were 1·8%, 2·1%, 2·3%. The blood urea was 78 milligrammes per hundred cubic centimetres. This patient is mentally subnormal.

CASE IV.—F.A. is aged seventeen years; his height is 145 centimetres (four feet ten inches), his weight 39·6 kilograms (six stone four pounds). His mother and father are well and show normal development. One brother (Case V) has chronic nephritis. His previous illnesses include plumbism (without paralysis), diphtheria, whooping cough and mumps.

FIGURE II.
Two brothers in Cases IV and V.

The systolic blood pressure was 145 millimetres of mercury and the diastolic pressure 110 millimetres. The Wassermann test yielded no reaction. Mosenthal's test revealed albumin in each specimen, with specific gravity ranging from 1·005 to 1·014, the quantity passed during the night was 300 cubic centimetres (ten ounces) and the day 720 cubic centimetres (twenty-four ounces). The figures obtained by the urea concentration test were 1·2%, 1·4%, 1·6%. The blood urea was 119 milligrammes per 100 cubic centimetres. This patient is mentally and physically active and is in constant employment.

CASE V.—R.A. is aged fifteen years. His height is 138·1 centimetres (four feet seven and a quarter inches), his weight is 36·4 kilograms (five stone eleven pounds); he is a brother of patient IV. He is a nail-biter, but has no history of having suffered from plumbism. He has had no previous illnesses.

The systolic blood pressure was 140 millimetres of mercury and the diastolic pressure 110 millimetres. The Wassermann test yielded no reaction. Mosenthal's test revealed albumin in each specimen, with specific gravity ranging from 1·010 to 1·015, the quantity passed during the night was 200 cubic centimetres (ten ounces) and the day 750 cubic centimetres (twenty-five ounces). The figures obtained by the urea concentration test were 1·1%, 1·8%, 1·8%. The blood urea was 94 milligrammes per hundred cubic centimetres. This patient is also mentally normal and is employed as an office boy.

Discussion on Cases.

In reviewing these cases it will be noted that in Cases I, II and III there is a definite history of lead poisoning with paralysis. The brothers in Cases IV and V both spent their childhood in a house where the paint was dry and powdery. Patient IV developed lead poisoning without paralysis. Patient V has no history of lead poisoning, but is a nail-biter, and his clinical signs and symptoms are identical to those of Patients I, II, III and IV.

The notes on these brothers have been purposely brought into this series to raise the question of the atypical case. Dwarfism, renal and vascular changes, habits of nail-biting, access to lead are all present, but they lack the objective sign of lead palsy. The presumptive evidence is in favour of the thesis that we are dealing with chronic lead poisoning in which neural changes have been either slight or absent. The alternative conception of an entirely different ætiology is certainly most difficult to explain. We believe that the commonly accepted view that "without palsy there has been no lead" has had far reaching and most unfortunate results. The whole issue has been clouded, the extent of the lead paint menace has been minimized, and in consequence literally thousands of children have been allowed to run the risks of lead absorption.

Considering the protean manifestation of almost every disease and the comparative rarity of a classical syndrome, it would be extraordinary if lead alone of all noxious agencies reacted in an invariable manner regardless of duration, access, age, dosage or the vagaries of individual metabolism. The evaluation of such gross changes as envisaged in the study of dwarfism only touches at the fringe, the intricate problem of cytopathology and physiology which results from the long continued ingestion of a poison which is carried to every tissue of the body.

Acknowledgement.

I wish to thank Dr. N. W. Markwell and Dr. Clive Sippe for referring patients to me for this investigation.

References.

(1) J. Lockhart Gibson: "A Plea for Painted Railings and Painted Walls of Rooms as the Source of Lead Poisoning amongst Queensland Children," *The Australasian Medical Gazette*, April 20, 1904, page 149.

(2) L. J. Jarvis Nye: "An Investigation of the Extraordinary Incidence of Chronic Nephritis in Young People in Queensland," THE MEDICAL JOURNAL OF AUSTRALIA, August 3, 1929, page 145.
(3) L. J. Jarvis Nye: "A Study of Chronic Nephritis in Queensland," The Australasian Medical Publishing Company, Limited, 1930.
(4) G. V. Ashcroft: Cited from "Medical Annual," 1931, page 410.
(5) G. V. Ashcroft: "Renal Rickets," *The British Medical Journal*, April 24, 1926, page 742.
(6) E. A. Park, D. Hackson, L. Kajdi: "Shadows Produced by Lead in Roentgen-Ray Pictures of Growing Skeleton," *The Journal of the American Medical Association*, June 6, 1931, page 1989.
(7) H. A. Harris: "Lines of Arrested Growth in the Long Bones of Diabetic Children," *The British Medical Journal*, April 25, 1931, page 700.
(8) Elliott Smith: *The Lancet*, November 6, 1926, page 943.
(9) Brissaud: Cited by Blumer in "Bedside Diagnosis," Volume I, page 591.

A NOTE ON AN ALLEGED ACTION OF ORALLY ADMINISTERED INSULIN.

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SINCE the discovery of insulin persistent attempts have been made to substitute oral for subcutaneous administration, but up to the present all such attempts have proved valueless. The work of the Toronto investigators has made it clear that certain plant extracts are capable of reducing the blood sugar, but it is not certain that this property is due actually to insulin, and they are careful to refer to these extracts as "insulin-like substances." In actual practice the various plant cures that have been reported as proving of benefit to diabetics have on investigation proved of little value.(1) It must be admitted, however, that insulin can be prepared from certain organs besides the pancreas, but here again the presence of guanidine and other substances complicates the picture. The claims made on behalf of synthalin and glukhorment have likewise proved valueless, since it has been shown that besides the toxic results ensuing on their administration, their actual mode of action is not physiological. Before we can even consider the therapeutic administration of a substance that lowers the blood sugar, we must first be assured that this lowering is of the same physiological order as that produced by insulin. The need for this precaution is realized when we consider the case of synthalin. It has been shown by Dale and his collaborators that insulin is capable of lowering the blood sugar of the spinal eviscerated cat (a preparation which essentially consists of muscle with its natural circulation intact) and, furthermore, that the sugar so disappearing is partly oxidized but chiefly stored as muscle glycogen. Such a preparation affords a very useful means for testing the physiological activity of any alleged insulin substitute. Thus, in the case of synthalin, it was found that a lowering of the blood sugar actually occurred in the above preparation,(2) but, unlike insulin, synthalin did not cause glycogen storage. Apart from the actual toxicity of synthalin, its failure to reproduce the effects of insulin in the eviscerated preparation should make one extremely dubious of its value in diabetic therapeutics. It seems reasonable, then, that before we accept any other substitute for insulin in the treatment of diabetes, we should first subject it to such a test as has been described above.

Recently Mukherjee(3) has claimed that a compound of insulin and phosphotungstic acid administered orally has a definite effect in lowering the blood sugar, and Leyton has described beneficial results from its use in diabetes.

On the other hand, Lawrence,(4) from a series of carefully controlled diabetic patients, concludes that this phosphotungstic-insulin has no therapeutic action in diabetes. Quite recently my attention was drawn to a paper by Collazo and Rubino(5) from which it would appear that insulin administered orally exerts a profound effect on carbohydrate metabolism. Briefly, the case made out by these workers is that the failure of orally administered insulin to produce a lowering of the blood sugar forms no justification for the assumption that insulin so administered exerts no effect on carbohydrate metabolism. It is argued that if insulin is absorbed from the stomach it should reach the liver *viâ* the portal vein and thus conform to the normal physiological mechanism in which insulin secreted from the pancreas first reaches the liver. In support of their contention experiments on well fed rabbits are described; some of these animals were fed with glucose alone, whilst others received glucose and insulin. The latter animals showed liver glycogen values 100% to 300% greater than those found in the animals which were fed with glucose alone, and accordingly the authors conclude that the orally administered insulin has exerted a profound effect on the glycogen metabolism of the liver. The liver glycogen figures for the control animals varied from 1·8% to 5·2%, the average on six rabbits being 3·8%, and in the animals which received insulin, from 4·2% to 15·3%, the average on seventeen rabbits being 8·89%. These results are sufficiently striking as to warrant careful consideration. There is, however, a considerable pitfall in such experiments with adult well fed rabbits. Macleod originally emphasized the fact that one can never predict with any degree of certainty the glycogen content of the liver of the adult rabbit, and on this ground the above experiments are open to criticism. If, however, we adopt Goldblatt's procedure(6) and work with young rabbits deprived of food for twenty-four hours, we can be reasonably certain that the glycogen content is of low and constant proportions. Such animals, therefore, offer suitable conditions for investigating the claims of Collazo and Rubino.

Experiment.

Five young rabbits from the same litter were taken and kept without food for twenty-four hours. Two animals were then fed with twenty cubic centimetres of 25% glucose and served as controls for three other animals which were fed with twenty cubic centimetres of 25% glucose containing two units of insulin. All the animals were killed three hours after the glucose feeding and the livers worked up for glycogen estimation according to the

method described in a previous paper.[7] The results are shown in Table I.

TABLE I.

Glucose alone.			Glucose *plus* Insulin.		
Number.	Rabbit Weight in Grammes.	Liver Glycogen *per centum.*	Number.	Rabbit Weight in Grammes.	Liver Glycogen *per centum.*
1	700	3·00	3	630	3·40
2	770	2·50	4	630	2·23
			5	780	3·00
Average		2·75	Average		2·80

In the above experiment the procedure as to glucose feeding, insulin administration and duration of experiment was similar to that described by Collazo and Rubino, but these results in young rabbits do not support the contention of these investigators that orally-administered insulin causes glycogen storage in the liver.

References.

(1) A. B. Corkill and A. Doutch: "An Investigation into the Alleged Therapeutic Properties of Vinca Rosea in the Treatment of Diabetes," THE MEDICAL JOURNAL OF AUSTRALIA, February 15, 1930, page 213.
(2) R. Bodo and H. P. Marks: "The Relation of Synthalin to Carbohydrate Metabolism," *Journal of Physiology*, Volume LXV, March 30, 1928, page 83.
(3) H. N. Mukherjee: "The Production of Hypoglycæmia in Rabbits by Oral Administration of Precipitated Insulin," *Journal of Physiology*, Volume LXX, 1930, page 182.
(4) R. D. Lawrence: "Insulin Phosphotungstate by Mouth," *The Lancet*, Volume CCXX, 1931, page 184.
(5) J. A. Collazo and P. Rubino: "*Primäre glykogenisierende Leberwirkung peroraler Insulingaben*," *Klinische Wochenschrift*, Volume IX, February 1, 1930, page 217.
(6) M. W. Goldblatt: "The Action of Insulin in Normal Young Rabbits," *Biochemical Journal*, Volume XXIII, 1929, page 83.
(7) B. Corkill: "The Influence of Insulin on the Distribution of Glycogen in Normal Animals," *Biochemical Journal*, Volume XXV, 1930, page 779.

Reports of Cases.

DERCUM'S DISEASE (ADIPOSIS DOLOROSA).[1]

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I WISH to demonstrate to you this woman, who is aged forty-eight years and whose menopause was manifest nine months ago. She had previously had two pelvic "spring cleanings," which, however, had apparently left her with a uterus and at least one ovary. While still under the care of her gynæcologist five months ago, she developed what was thought to be an acute parotitis, characterized by painful bilateral swelling in these areas. This was followed by a generalized irritable eruption, thought to be seborrhœic in origin, which yielded to small doses of X radiation. She continued to complain of pains in the limbs, which were termed rheumatic, but which quite failed to respond to ordinary measures, and so found her way to the medical out-patient department.

These additional facts were then elicited. She has in addition had a considerable amount of numbness and tingling in her arms and legs, with a good deal of aching neuralgic pains in the upper arms and trunk. The swellings in the subtemporal regions had never disappeared, and fresh ones had developed some three weeks previously on the outer aspects of both arms, all of which caused her much pain and distress. She felt herself becoming weaker,

FIGURE I.
Showing swelling of face.

could no longer do her domestic work, and was continually irritable, depressed and weeping. She complained further of constipation and an exaggeration of her misery during the cold weather. Though always obese, she had lost 6·3

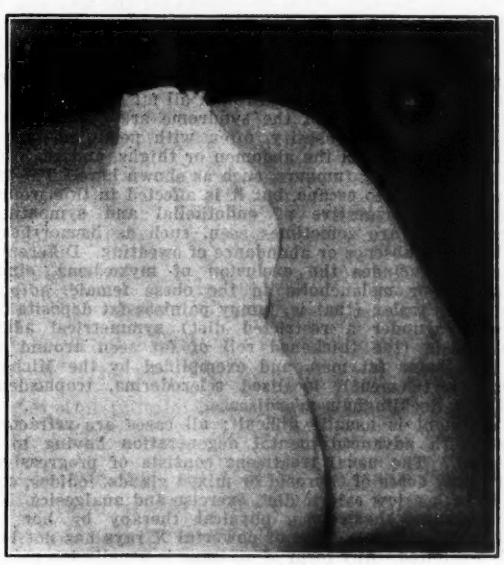

FIGURE II.
Showing swelling of arm.

kilograms (a stone) in weight during the previous two months.

Examination revealed her to have a heavy looking melancholy expression and a subthyreoidic appearance,

[1] Read at the Second Annual Reunion of the Royal Prince Alfred Hospital Residents' and Ex-Residents' Association, September, 1931.

which, however, could not be confirmed in any other detail than scanty outer thirds to her eyebrows and that her thyreoid was small, but distinct to palpation. Symmetrical swellings were evident over both parotids and subdeltoid regions, the former painless, the latter acutely tender. These tumours had no definite edge and were partially adherent to the overlying skin. The adjacent subcutaneous tissue was shotty and nodular, like a bag of dried peas. Both hand grips were weak, but no anæsthesia could be demonstrated or other involvement of the central, peripheral, or sympathetic nervous system. No signs, either radiographic or clinical, pointed to pituitary enlargement or disturbance. There was no alteration in the urea or cholesterol of the blood or in the glucose tolerance curve. A Wassermann test on the blood gave no reaction and her basal metabolism was recorded as −5%. She is under treatment by a reduced diet and increasing doses of iodide and thyreoid extract. Even light massage to the tumours was too painful, but, in her own words, she has "experienced greater relief from hot-air treatment than she has had for years." It is proposed further to try the effects of diathermy and mild deep X ray therapy. Her mental condition is considerably brighter, and she is delighted with her progress so far, though a further swelling is becoming apparent in her left foot.

This is an example of the rather rare affliction known as *adiposis dolorosa*, first described by Dercum, of Philadelphia, in 1888. Any panniculitis may usually be described as a "painful adiposity," but to conform to Dercum's original syndrome there must be the mental features of asthenia or depression, and paræsthesia, in addition to painful indurations in the subcutaneous layer of the trunk and limbs. The great majority of cases have occurred in women at or about the menopause. There is no familial predisposition or known single ætiological factor beyond a frequent neuropathic basis. My own supposition is that the lesion is of the nature of a subacute focal inflammation with peripheral neuritis, secondary to infection elsewhere, and that the mental changes are secondary to the continuous neuralgic distress. In some of the reported cases thyreoid atrophy or pituitary dysplasia has been reported after autopsy microsection. There is no certain evidence of such in this woman. Waldorp postulates a derangement of the diencephalic centres controlling fat metabolism, inculcating the suprarenal to account for the asthenia, the thalamus to account for the pain.

In this regard it is opportune to recall the work of Wilkinson and others in our own medical school, who, using *intra vitam* stains, demonstrated the bountiful network of nerve fibres ending around all fat cells.

Two clinical types of the syndrome are described, one with a generalized obesity, often with pendulous aprons of fat hanging from the abdomen or thighs, and the other with painful fatty tumours, such as shown here. The face is usually said to escape, but it is affected in this woman. Phenomena suggestive of endothelial and sympathetic derangement are sometimes seen, such as hæmorrhages, ecchymoses, absence or abundance of sweating. Differential diagnosis includes the exclusion of myxœdema, simple neuralgia or melancholia in the obese female, *adiposis tuberosa simplex* (that is, lumpy painless fat deposits disappearing under a restricted diet) symmetrical adenolipomatosis (the thickened roll of fat seen around the neck in some fat men, and exemplified by the Michelin tire advertisement), localized scleroderma, trophœdema, and von Recklinghausen's disease.

Treatment is usually difficult; all cases are refractory, some with advanced mental degeneration having to be certified. The usual treatment consists of progressively increasing doses of thyreoid or mixed glands, iodides, combined with a low caloric diet, exercise and analgesics. For the tumours themselves, physical therapy by hot air, diathermy or small doses of powerful X rays has not been fully exploited. Any form of massage is usually too painful to bear. Finally, it is worth bearing in mind that *adiposis dolorosa* is probably not an enclosed clinical entity, though certain cases, such as this, closely approach Dercum's original description. What is needed in the elucidation of this condition is a full *post mortem* examination of the whole central peripheral and sympathetic nervous system by modern neuro-pathological methods.

Reviews.

THE SURFACE OF THE BODY AND ITS MOVEMENTS.

"ANATOMY IN THE LIVING MODEL," by Professor David Waterston, is a welcome addition to the standard works on anatomy.[1] He has successfully accomplished his desire of linking the knowledge gained in the dissecting room to the observations made on the living model at rest and in action. The author presents all that we are accustomed to look for in works on surface anatomy.

In the first section of the book the author discusses in a brief but instructive way the examination of the skin-covered surface of the body, the physical characters of the skin, the question of nerve and arterial areas, and the localization of touch, pain, and warm and cold spots. An intermediate section follows, and this forms the major portion of the work; it is subdivided into the usual anatomical divisions. In this section the author approaches most closely to what is commonly regarded as "surface anatomy," though he goes much further in that he deals with movements and discusses the bones, the joints and the muscles and the physical principles illustrated in their actions.

The final section consists of an appendix of practical exercises, that is, methods of taking finger prints, the demonstration of the colour of the bloodless skin and the microscopical demonstrations of skin capillaries. The author's chief concern throughout the work is showing the relation of structure to function.

The illustrations, many of which are coloured, are excellent and sufficiently numerous to be of material help in the enjoyment of the book, which is one that can be recommended with every confidence to all interested in the study and teaching of anatomy.

THE PATHOLOGY OF BONE.

"CLINICAL OBSERVATION ON THE SURGICAL PATHOLOGY OF BONE," by David M. Grieg, Conservator of the Museum of the Royal College of Surgeons, Edinburgh, is a volume of 242 pages, well printed and well illustrated with photographs of specimens from the Museum of the Royal College of Surgeons, Edinburgh.[2]

In the first chapter the author discusses the physiology of the theories of bone growth. He also lays down his own thesis, namely, that the periosteum is a limiting, not a bone-forming layer, and that it serves as a pathway for the blood and lymph vessels and for the nerves to the bone which it ensheaths. He stresses the point that bone is a living tissue and, like all living tissues, it reacts to changes in its blood supply: hyperæmia leads to bone rarefaction, ischæmia leads to osteosclerosis, while obliteration of blood supply leads to necrosis. The rôle of calcium in bone formation is also interestingly discussed and its importance in all bone changes is emphasized. In the subsequent chapters the author shows how his theories fit in with the observed facts in acute and chronic osteomyelitis, in tuberculosis, in syphilis, in new growth, and following trauma.

Throughout the work the specimens from the college museum form the material to demonstrate the author's theory and to impress and illustrate his points. The book is extremely easy to read and one in which those interested in bone pathology will find much of interest and value.

[1] "Anatomy in the Living Model: A Handbook for the Study of the Surface, Movements, and Mechanics of the Human Body and for the Surface Projection of the Viscera, et cetera," by D. Waterston; 1931. London: Hodder and Stoughton Limited. Royal 8vo., pp. 272, with illustrations. Price: 25s. net.

[2] "Clinical Observations on the Surgical Pathology of Bone," by D. M. Grieg, M.B., C.M., F.R.C.S., F.R.S.E.; 1931. Edinburgh: Oliver and Boyd. Demy 4to., pp. 259, with 224 illustrations. Price: 30s. net.

The Medical Journal of Australia

SATURDAY, DECEMBER 26, 1931.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

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PROSPECT.

SOMEHOW or other it has become usual for medical orators to speak of recent triumphs, to point out that in bygone times little was known of the causation of diseases which are understood today, and that no thought was given to the prevention of disease. Step by step the progress of medicine has been traced by one and another, the milestones on the road have been numbered and the triumphs that marked the erection of each stone have been put on record. It is well so to do, for to reconstruct the difficulties of the past and to recount the efforts made to overcome them is the best possible stimulus for flagging energies. The present is often considered, a stocktaking is held, and available reserves in material advantages and mental forces are assessed. Attention is not so often paid to the future. At the end of each year it is well to make plans for the next—"The King is dead, long live the King" is a time-honoured cry. A year ago a note of optimism was sounded in these columns; and there was need—the air was heavy with evil forebodings, financial chaos appeared imminent and the political clouds were threatening.

What is the situation today? From the economic standpoint the outlook may appear gloomy. At the same time matters might be worse. Many people have received hard knocks. Some have taken them in a fighting spirit and have battled on; others maybe have given ground and a certain number have been temporarily overwhelmed by sheer weight of adversity. The medical profession has been called upon to make sacrifices greater than those of any other profession. Disease is as prevalent as ever, medical practitioners are working at high pressure, but many patients are quite unable to pay for the service they receive. The general public has little conception of the load that has been and is being carried by medical practitioners. We have yet to learn of any person, sore beset by financial difficulties, who has appealed in vain for treatment to a medical practitioner. This statement is not made in a boastful spirit, or from vainglory, or to claim merit. It is made so that people may know and possibly understand. The attitude of the medical profession appears strange to many people, for it of all the professions strives to prevent the occurrence of that from which it derives its daily bread—it sets up prevention of disease as the goal to be reached—and it does not advertise its gratuitous service. If the non-medical public understood the traditional attitude of its doctors, the cry for further and still further reduction in fees for contract practice would not be heard so often, nor would deliberate imposture be such a vogue as at present. The public must realize that there inevitably will be an end to the resources of each medical practitioner.

But this savours of pessimism. Reference has been made to milestones on the road of medical progress. The year that is closing has been a year of trial and tribulation; on the milestone marking it the word service will be writ large. Medical practitioners must take heart for the future, lest they grow weary in well-doing. If their feet are set in the path of tradition, if they are girt with the sword of determination, if they are clothed in the armour of rightful purpose, they will journey far along the road of a brighter future and will be able to lighten the burden of the sick in body and the weary in spirit.

Current Comment.

THE CONTROL OF TUBERCULOSIS.

In view of the special tuberculosis number of this journal published a month or two ago, and of the emphasis laid on the need for early recognition of tuberculous infection, it will be found of interest to study steps taken in other countries in this direction. R. S. Gass and E. L. Bishop report the results of a three years' programme of tuberculosis control in Tennessee, and A. S. Pope gives a progress report of the ten years' programme in Massachusetts.[1] Gass and Bishop point out that in Tennessee there are established throughout the State tuberculosis "case-finding clinics," whose primary object is to discover tuberculous infections unknown to medical practitioners, particularly incipient infections without significant symptoms. The Health Department acts as a case-finding agency and as a link between persons with previously undiagnosed infections and medical practitioners. The *clientèle* of the clinics is chosen essentially from: (i) Contacts of known tuberculous patients, (ii) members of a household or family in which has occurred a death from tuberculosis, (iii) individuals suspected and referred for definite diagnosis, and (iv) individuals already diagnosed as infected or suspicious, for reexamination. Those attending the clinics come from the section of the population most exposed to infection, in whom the greatest case incidence would be expected. All control measures must include childhood tuberculosis and tuberculin testing of children must be done before the child attends the clinic. Children are not admitted to a clinic without the record of the tests. In tuberculin testing the following groups receive preference in the order indicated: (*a*) Children, aged fourteen years or less, who have been or are in contact with a tuberculous patient; or (*b*) with a person suspected of being tuberculous; (*c*) children of a school or preschool age tested as a routine. The Mantoux intracutaneous test was employed. An initial dose of 0·01 milligramme was used, followed by 1·0 milligramme if the test gave no reaction. In tuberculosis of childhood physical examination may reveal very little; so all children with positive reactions are submitted to X ray examination. X ray examination is also deemed necessary for those children considered on physical examination to be suspects; also for those previously diagnosed as "positive." In these cases X ray examination is required to determine the advisability of producing pneumothorax or using thoracoplasty or phrenicotomy as therapeutic measures. Not every person is examined by X rays. Patients may be reexamined once or more often to consider the progress made, but those becoming completely bedridden after the first examination are excluded from reexamination. Females exceeded males in the proportion of $1\frac{2}{3}$ to 1. The median age was twenty-one years. Eliminating arrested and quiescent infections, the percentage of active cases was greatest among females between the ages of twenty-five and thirty. In males the incidence of active disease continued increasing up to sixty years. Of 364 persons found normal on the first examination, 9·7% were subsequently classed as suffering from active or quiescent tuberculosis. As regards clinical improvement, there was little apparent effect of age in males, but older females had a rather worse prognosis than those younger. On the whole, females made less favourable progress than males, and showed more tendency to retrogress than males. In both sexes older persons had a less favourable course than those younger. In females the probability of an unfavourable change was relatively high at all ages above fifteen; for males the probability of retrogression was relatively low until at least ten years later. During the past decade the mortality rate has declined considerably, but still the death rate from tuberculosis in Tennessee is much greater than that for the United States Registration Area. In 1929 the rate for the State was 120·3 per hundred thousand of the population; for the Registration Area it was 76. The death rate in the negro race was nearly three times that of the white population.

In the Massachusetts investigation Pope records that the grade school children constituted the group examined, as infection was found to have taken place in a considerable number at that age. The intention was to pick out infected individuals before active disease had developed. Since the summer of 1929 the clinics have been extended to embrace high schools. Pope admits that the intracutaneous (Mantoux) test is more delicate than the Pirquet. The amount of old tuberculin absorbed from the Mantoux test is accurately known. There are more reactors to the Mantoux than to the Pirquet test, the difference being from 4% to 5% usually, but up to 25%. For practical purposes, however, the scarification (Pirquet) test may, in Pope's opinion, be deemed almost equal in value to the Mantoux test. The simplicity of the Pirquet test makes it more acceptable when parental consent has to be obtained. Thus it is possible to examine a larger proportion of the school population. The needle is more objected to than scarification. The arms are examined seventy-two to ninety-six hours after the scarification, and all children reacting are examined by X rays. Physical examination is reserved for those displaying X ray evidence of tuberculosis. During the first six years of the programme 140,000 school children were tested by Pirquet's method. In different communities the percentage of reactions varied from 16 to 34, being 26 for the whole number. The proportion of reactors was more than twice as great among contacts as non-contacts, but there was no difference in the incidence of reactions in children of normal weight and under weight. The ratio of reactors rose consistently from 15% at five years of age to 50% at the end of high school age. It was twice as high among high school as in grade pupils. There was

[1] *The Journal of the American Medical Association*, September 19, 1931.

practically no difference in the incidence in the sexes. Studies on 4,000 school children in Massachusetts indicate that over 90% of those with tuberculous lesions demonstrable by X rays react to the Pirquet test. In some of the cities examined there was definite correlation between the tuberculosis death rate, the percentage of reactors in the public schools and the proportion of pulmonary tuberculosis found in school children. In a group of children followed from two to six years, more pulmonary tuberculosis developed among those with the childhood type of the disease than in a "suspect" group. Exposure to open pulmonary tuberculosis in the household appeared to be the most important single factor in the development of tuberculosis in children. It is held that control methods should include the family in addition to the infected person.

The papers of Gass and Bishop and Pope bear witness to an immense amount of painstaking investigation. It must, however, always be borne in mind that a positive response to the Pirquet or Mantoux test simply indicates that the person concerned has at some time been invaded by the tubercle bacillus, and not necessarily that an active tuberculous process is present. This was emphasized recently in this journal in a special article by Cotter Harvey. Enlarged glands in children are not always tuberculous, nor is the under-nourished child invariably tuberculous. Radiographic diagnosis of pulmonary tuberculosis again depends largely on the personal factor in interpretation. Possibly many X ray diagnoses of tuberculosis are erroneous. After all, apart from animal inoculation, there is only one final and conclusive test for active tuberculosis, and that is the finding of the tubercle bacillus; this is not mentioned in either of the articles. An X ray examination of the school children throughout the States of Australia would not be practicable. Where electrical installations do not exist, the difficulties of transport of the apparatus would be insuperable. It is doubtful whether wholesale X ray examination is necessary. It would be more satisfactory to rely on the Pirquet and Mantoux tests, if they were considered in conjunction with other findings. After the Pirquet test has been made, seventy-two to ninety-six hours is too long a time to wait for examination; by that time many reactions will have subsided. This is, of course, a detail. What is of importance is that investigators in at least two large centres in America are seized with the importance of the control of tuberculosis.

Special Articles on Aids to Diagnosis.

(Contributed by Request.)

X.

THE WIDAL TEST.

WHEN serum from a normal person is mixed in a test-tube with a suspension of typhoid bacilli in salt solution, the bacilli remain separate and evenly distributed throughout the mixture, which shows a uniform faint cloudiness. If serum obtained from a typhoid patient is mixed with a similar suspension, after a short interval the bacilli will usually be found to have stuck to one another or agglutinated, so that they form, first, fine flocculent masses suspended in the solution and, later, an obvious white deposit below the perfectly clear fluid.

This agglutination reaction (Widal's test) may be used as an aid in the diagnosis of typhoid fever. The agglutinins, which are the substances responsible for the sticking together of the bacilli, usually begin to be demonstrable in the patient's serum about a week after the onset of the disease. They rapidly increase in quantity during the second week, and somewhere about the eighteenth or twentieth day they reach a maximum. After this the concentration of the agglutinins steadily decreases over a period of several weeks, finally reaching a level considerably below the maximum and continuing at about that level for a number of years.

It is therefore apparent that the Widal test cannot be used for the diagnosis of typhoid fever until after the first week of the disease. From this time onward one can expect that the test will give a positive result in the great majority of cases of typhoid infection. In a few very severe cases, with absence of antigenic response on the part of the patient, agglutinins may never appear at all; and occasionally in mild cases the amount of agglutinins formed may be too small to establish the diagnosis; but in most cases of typhoid fever in the third week the patient's serum will agglutinate the bacilli even in such high dilutions as one in 1,000. Agglutination with a serum diluted one in 50,000 is not infrequent. The highest dilution of a serum which will agglutinate a standard emulsion of a certain species of bacillus is called the agglutinin titre of the serum for that bacillus.

The paratyphoid bacilli seem to show less regularity in stimulating the production of agglutinins. Serum from patients infected with *Bacillus paratyphosus B* will sometimes agglutinate the corresponding bacilli in dilutions even higher than those effective with typhoid cases; but with paratyphoid *A* infections the agglutinin titre is likely to be much lower, often about one in 25.

It is useful to do a Widal test in the first week of a suspected typhoid infection, although it will not directly establish the diagnosis. Its value lies in the fact that it will reveal the presence of any typhoid agglutinins which might be present in the patient's serum as a result of an inoculation or a previous, perhaps unrecognized, infection. In this way it will be of great assistance in interpreting the significance of a second test applied a week later.

Methods of Performing the Test.

Two methods of performing the Widal test will be briefly described. The macroscopical method is used to establish the agglutinin titre of a serum, while the microscopical method determines only whether or not agglutination takes place at one particular dilution. The latter method is not capable of definitely establishing a diagnosis; but it has, owing to its simplicity, a real usefulness to the country practitioner.

Reagents.—The reagents required are: (i) Patient's serum, (ii) standard agglutinable suspensions of bacilli, (iii) normal saline solution (0·85% sodium chloride).

Collection of Blood.—For the macroscopical test it is desirable to obtain about three cubic centimetres of blood, though it is possible, by a modification of the method, to use considerably smaller quantities. The best way to obtain it is from a vein. A syringe employed for this purpose must be perfectly free from tap water, which causes hæmolysis of some of the red cells, even when it is present in very small quantity. A good procedure is to rinse out the syringe with sterile saline solution after it has been boiled. The blood should be expelled from the syringe into a clean dry glass test tube or bottle. The Behring "venule" is a very convenient substitute for a syringe. It must be of the plain type, containing no chemicals. Alternatively, the blood may be collected from a needle prick in the finger or the lobe of an ear. The

needle used should have a cutting edge, not a plain round point. The best plan is to let the drops of blood fall into a clean dry test tube, using pressure to increase the flow. A Wright's tube is very convenient for taking up and carrying the blood for a microscopical test, where only about 0·5 cubic centimetre is required; but, except in the hands of an expert, it can seldom be made to take up enough blood for the macroscopical test.

Separation of Serum.—The blood, by whatever method it has been collected, should be allowed to clot undisturbed. About half an hour after collection it is desirable to loosen the clot gently from the walls of the container. This may be done with a sterile platinum wire or glass rod, or by gently knocking the container with the finger. Agitation before clotting has occurred, or vigorous shaking afterwards, tends to liberate red cells from the clot, making it more difficult to obtain clear serum without centrifuging, and also tending to encourage hæmolysis. The serum is usually separated from the clot by centrifuging, but if the blood is allowed to stand for some hours it will generally be easy to withdraw some clear serum with the aid of a pipette and rubber teat. The serum obtained should be free from red cells, perfectly clear and pale straw coloured.

Sending Blood to a Laboratory.—If the specimen is to be sent to a laboratory to be tested, it is best to leave the whole blood in its original container, provided it will reach its destination within twenty-four hours. Should a longer journey be necessary, it would be preferable to separate the serum, with precautions against bacterial contamination. The serum will retain its agglutinating property for a long period if it is sterile; but specimens collected by any method except the "venule" will usually be contaminated with bacteria. By the multiplication of the bacteria the specimen will be spoiled, so that it is necessary, when the blood is to be sent away, to make every effort to avoid bacterial contamination and to keep the specimen, as far as possible, at a low temperature.

Bacterial Suspensions.—The bacterial suspensions used consist of killed bacilli in normal saline solution. Suspensions prepared by different methods or from different strains of bacilli of the same species show marked differences in their sensitivity to agglutination. It is essential that standard agglutinable suspensions should be used for the Widal test. These must be prepared by a skilled bacteriologist, but in Australia they are readily obtained from the Commonwealth Serum Laboratories. A ten cubic centimetre phial of each of the organisms to be tested will be required for the macroscopical test, or a one cubic centimetre phial for the microscopical method. It is usual to test each serum with four species of bacilli, *Bacillus typhosus* and *Bacillus paratyphosus A, B* and *C*. Other organisms sometimes used are *Bacillus enteritidis* Gaertner and *Bacillus aertryke*.

Saline Solution.—The saline solution used for diluting the serum is the ordinary 0·85% sodium chloride. The strength of the solution should not be varied beyond a narrow margin or it will alter the sensitivity of the bacilli to agglutination.

Macroscopical Test.

The apparatus required for testing one serum against four species of bacilli is: (i) Twenty-eight test tubes; a convenient size is three inches by three-eighths of an inch. (ii) Racks to hold the test tubes in rows of seven. (iii) Pipettes to deliver 0·5 cubic centimetre volumes. One cubic centimetre pipettes, graduated to deliver to the end, and fitted with a rubber teat, are very convenient. One pipette should be used for each serum to be tested and another for each bacillary suspension. (iv) A water bath heated to 55° C., suitable for holding the test tubes.

Method.—Arrange the test tubes in rows of seven, one row for each species of bacillus. Measure 0·5 cubic centimetre of saline solution into each tube. Make a one in five dilution of the patient's serum and measure 0·5 cubic centimetre into the first tube of each row. Mix it with the saline solution in the tube by drawing up into the pipette and expelling.

Taking each row of seven tubes in turn, take up 0·5 cubic centimetre of the mixture from the first tube and put it into the second. Mix the contents of the second tube, take up 0·5 cubic centimetre and put it into the third, and so on until the seventh tube is reached, when 0·5 cubic centimetre of the final mixture is discarded. In this way each tube will be left with 0·5 cubic centimetre of a serum dilution. The dilutions in each row will be 1/10, 1/20, 1/40, 1/80, 1/160, 1/320 and 1/640. Now, with a clean pipette, put 0·5 cubic centimetre of the suspension of typhoid bacilli into each tube of the first row. When the suspension has been added to the whole row the pipette may be used to mix the contents of each tube, starting at the seventh tube (highest dilution) and mixing each tube in order to the first. The other rows are then dealt with in the same way, using *Bacillus paratyphosus A* for the second row, *Bacillus paratyphosus B* for the third row, and *Bacillus paratyphosus C* for the fourth. The final dilutions of the serum will now range from 1/20 to 1/1280, each tube containing one cubic centimetre of fluid, which shows a faint, even cloudiness. The rack of tubes is placed in the water bath at 55° C. for two hours, after which the result may be read. Tubes in which no agglutination has taken place, will appear unchanged; but where the bacilli have agglutinated, they will have fallen to the bottom of the tube as a whitish, flocculent precipitate, leaving a clear supernatant fluid. Near the end point of agglutination the bacilli may appear as fine flocculent masses still partly suspended in the fluid. If any organism is agglutinated in the highest dilution, 1/1280, a further series of dilutions can be tried if it seems desirable, say, 1/2560, 1/5120 and 1/10240. These higher dilutions are not likely to be necessary for purely diagnostic purposes.

Permissible Modifications of the Macroscopical Method.—The 0·5 cubic centimetre volumes of reagents used in the method described above are convenient to handle, easy to measure accurately, and give an easily read result; but a minimum quantity of 0·4 cubic centimetre of serum is required. If this amount cannot be obtained the test may be carried out with smaller volumes, say, 0·1 cubic centimetre instead of 0·5 cubic centimetre. In this case smaller test tubes (two inches by one-quarter of an inch) will be required, and suitable pipettes.

The optimum temperature for the reaction is 55° C. and at this temperature a period of two hours is sufficient to allow for agglutination to take place. If a water bath is not available, the tubes may be placed in an incubator at 37° C. for four hours or may be left at room temperature (20° C.) for twelve hours. The agglutinin titre obtained by these different methods will not differ to a significant extent; but when two or more tests on the same patient are to be compared, the method used must be strictly the same in each case.

Controls.—When occasional single tests are being done, it is advisable to employ positive and negative controls. The negative control tubes contain the bacillary suspensions, with saline solution, but no serum, while for the positive controls the agglutinating sera supplied by the Commonwealth Serum Laboratories may be used.

Microscopical Method.

For the microscopical method the following apparatus is required: (i) A microscope with a high power dry objective (one-sixth or one-third inch). (ii) Four microscope slides with eight cover slips. (iii) A platinum wire loop. (iv) A graduated pipette for diluting serum. The white cells pipette of the hæmocytometer may be used.

Method.—Make a one in twenty dilution of the serum in saline solution. If a white cells pipette is used for this purpose, take up serum to the mark 0·5 and then saline solution to the mark 11.

On each of the four microscope slides make two rings of vaseline, of a size to fit the cover slips. In the centre of one ring on each slide put one loopful of the one in twenty serum dilution, and in the other rings put one loopful of saline solution without serum. Add to each ring one loopful of bacillary suspension, using *Bacillus typhosus* on the first slide and *Bacillus paratyphosus A, B* and *C* on the second, third and fourth slides respectively. See that the slides are marked, to distinguish one from another, and mix the contents of each ring. Then apply the cover slips and press them down till they come in

contact with the vaseline all round their edges and with the mixed fluids at their centres. Leave the slides for thirty minutes in a warm place (25° to 35° C.) and then examine them with a high power and dry objective. The aperture of the substage diaphragm must be small, as for examining urinary deposits. The individual bacilli should be clearly seen. In the control rings containing no serum they should be isolated and show Brownian movement. Where agglutination has occurred they are gathered into obvious clumps and show no movement.

Interpretation of Results.—The interpretation of the result of the test is unfortunately complicated by the fact that agglutination may occur in conditions other than an existing infection.

Normal Agglutinins.—Occasionally serum obtained from a normal person, uninoculated and apparently uninfected, is found to agglutinate one or more of the bacillary suspensions. Such agglutination, which is probably the result of a previous unrecognized infection, occurs usually in the lower dilutions only (1/20 to 1/40), but may rarely be obtained even at 1/640. The titre of the serum in these cases will remain constant over a period of several weeks.

Inoculation Agglutinins.—Agglutinins appear in the blood of a person who has been inoculated with a typhoid-paratyphoid vaccine (T.A.B.). As in the case of an infection, these agglutinins reach a maximum concentration about three weeks after inoculation and then fall to a constant level, which is maintained for many years. The titre of inoculation agglutinins for typhoid bacilli, after the constant level has been reached, will usually be about 1/320 to 1/640 and will remain at the same point when two or more tests are done during a period of several weeks.

When an infection occurs in an inoculated person the agglutinin titre for the organism concerned, starting from its constant level, shows a rise and subsequent fall similar to those in an uninoculated patient. At the same time the titre of the agglutinins which will be present for the other organisms inoculated, may show a similar but usually slight fluctuation. It is only the demonstration of a change in agglutinin titre during the illness that can give useful information, and it may be very difficult to determine which of the organisms is responsible.

Recognition of Infection Agglutinins.—In the absence of a recent inoculation an agglutinin titre over 1/1000 may be taken as evidence of an existing infection. When a lower titre is demonstrated, the diagnosis cannot be made with certainty from a single test. It becomes necessary to repeat the test after an interval in order to determine whether the reaction is due to infection agglutinins or to normal or inoculation agglutinins. If there is no infective process, the agglutinin titre will be the same in the second test as it was in the first. If the second test shows a rise in the agglutinin titre we have conclusive evidence of infection, even though the titre obtained may be quite low (1/40). The maximum agglutinin titre is obtained about the twentieth day of disease. When this stage is passed before a second test is made it becomes more difficult to establish the diagnosis, since the subsequent fall in agglutinin titre is much more gradual than its rise. Even in such a case a series of tests may reveal the changing titre and so yield satisfactory evidence that an infection has occurred.

The value of a Widal test performed in the first week of the disease can now be appreciated. If such a test reveals no agglutination at any dilution, the subsequent demonstration of a titre even as low as 1/20 during the following weeks will be significant.

Cross Agglutination.—It sometimes happens that a patient's serum agglutinates more than one variety of the bacilli. This is likely to happen when inoculation agglutinins are present, since the vaccine ordinarily used contains *Bacillus paratyphosus A* and *B* as well as *Bacillus typhosus*; but it may also occur in cases of infection owing to the presence of group agglutinins, which act on bacilli of closely related species as well as on those responsible for the infection. When cross agglutination occurs, it becomes a matter of considerable difficulty to decide which organism is the infecting agent.

Interpretation of Microscopical Test.—The microscopical method, as outlined above, with a single serum dilution of one in forty, can never be taken as providing conclusive evidence of infection, unless a positive result is obtained a week or two after a negative. On the other hand, a negative result obtained in the third week of an illness would have some value as evidence of the absence of typhoid infection.

Value of the Test.—The Widal test is an indirect and often an unsatisfactory method of confirming a diagnosis. The cultivation of the bacillus from blood, stools or urine is much more satisfactory, but is only successful in about 70% of cases. A leucocyte count is very valuable and should never be neglected. The greatest value of the agglutination test depends on the fact that the agglutinins can be demonstrated in almost every case of typhoid fever at a suitable stage. The exceptions do occur, but they are very rare compared with the frequent failures in cultural methods. The failure of a patient's serum to agglutinate typhoid bacilli, even in low dilutions, in the third week of an illness, is almost conclusive evidence that the illness is not typhoid fever. To obtain, by means of the Widal test, positive evidence that an illness is typhoid fever, it is usually necessary to do more than one test so as to demonstrate a change in the titre of the serum.

J. H. B. WALCH, M.B., B.Sc.,
Hobart, Tasmania.

British Medical Association News.

SCIENTIFIC.

A MEETING OF THE NEW SOUTH WALES BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the Robert H. Todd Assembly Hall, British Medical Association House, 135, Macquarie Street, Sydney, on October 29, 1931, DR. GEORGE BELL, the President, in the chair.

Tuberculous Disease of the Hip.

DR. R. B. WADE read a paper entitled: "Tuberculous Hip" (see page 799).

DR. D. J. GLISSAN read a paper entitled: "Tuberculous Disease of the Hip Joint" (see page 803).

DR. GUY GRIFFITHS, in opening his remarks, said that it was with some trepidation that he, a physician, ventured to speak on such a subject. He was in agreement with Dr. Glissan that tuberculosis of the hip was a local manifestation of a general disease and that therefore treatment should invariably be conservative. Sir William Arbuthnot Lane had reported that he found the operation that he was accustomed to perform for other conditions to be useful also in cases of tuberculosis of the hip; this operation was excision of the colon. It should be stressed that tuberculosis of the hip was a local manifestation of a general disease. The main reservoir of the general disease was in the bronchial lymph glands; there it was that the tubercle bacilli lived and developed, and from there they passed into the general circulation and settled in a *locus minoris resistentiæ*.

Dr. Griffiths thought that the reason that operative treatment of the hip itself, such as was customary thirty or forty years ago, went out of fashion was that secondary infection and general toxæmia supervened, so that patients died; also, even when they did recover and when healing eventually occurred, they still suffered from tuberculosis elsewhere in the body.

The advantage of the conservative treatment of the last twenty years was that it permitted the natural curative powers of the body to deal with the general tuberculous infection. Treatment by rest, at first in bed, by extension, splints, fresh air, sunshine, generous diet and such tonic mixtures as were advisable, had a beneficial effect, not only on the tertiary tuberculous lesion, but on the primary and secondary tuberculous lesion. The primary lesion might be in the tonsil, in the intestine, or in a small bronchial ulcer, and the secondary lesion in the cervical, mesenteric or bronchial glands, most often the bronchial glands.

It might well be said that whereas in other parts of the world, in England at Hayling Island, and in Switzerland at Leysin, direct sunlight was required for treatment of children, in Sydney caution should be observed and the patient should be exposed to the sun only in the early morning or late in the evening until he was accustomed to the treatment. In fact, Dr. Griffiths thought that treatment should be by diffuse sunshine rather than by direct sunlight, except in the winter. But there was no question as to the value of such treatment.

Dr. Glissan had said that over and above other treatment it was advantageous to have injections of tuberculin. Dr. Griffiths thought that tuberculin was beneficial, even more in surgical tuberculosis than in pulmonary tuberculosis, because in surgical tuberculosis the infection was purely tuberculous and might remain so for weeks or months or years, whereas in pulmonary tuberculosis there was a mixture of infections. Tuberculin was of no use against an added staphylococcal or streptococcal infection, and once a secondary infection occurred it was more important to treat for the staphylococcal or streptococcal than for the tuberculous infection. In pure tuberculosis, if combined hygienic and specific treatment was used, not only did the late tertiary lesion improve, but the primary or secondary infection from which the patient formerly suffered also healed. For these reasons Dr. Griffiths did not recognize any such condition as surgical tuberculosis. Patients with tuberculosis of the hip were best treated by a surgeon with strong medical and conservative views, or else by a surgeon and physician in collaboration. Dr. Griffiths did not wish to suggest that the physician could do without the surgeon; he required his help in correct splinting, extension *et cetera*.

In conclusion, Dr. Griffiths stressed the fact that tuberculosis of the hip or of any other joint was a local manifestation of a general disease. Any tuberculous lesions were dangerous to the patient, and treatment should benefit not only the local lesion, but the constitutional infection that had preceded the local manifestation.

DR. N. D. ROYLE wished to join issue with Dr. Wade as to the different positions of the leg resulting from tuberculous hip. He could not agree that the effects of adduction and abduction of the limb were as Dr. Wade affirmed. Dr. Royle had seen many patients suffering from tuberculous hip paraded in Boston, and had no hesitation in saying that those with moderately adducted and flexed hip had better function than those with abducted hip.

Dr. Royle observed that tuberculosis was comparatively rare now in Boston, as well as in London; this reduction in incidence had been attributed to a change in the milk supply in these cities.

DR. W. VICKERS said that Dr. Griffiths may have given the idea that there was a tendency now to go back to the bad old days of resection of hip joints. Extraarticular fusion was performed by sliding up a piece of bone from the neck of the femur or by taking a piece of bone from the *os innominatum*. He thought that a very good summary of the position today had been given. In regard to conservative methods, it might be said that often the results attained were not completely satisfactory, even after a long time. But a long time was essential, because the condition involved not only a local lesion, but a general condition.

Plaster treatment had been given up, because the spica covered up a large area of the body surface and made exposure to the sun impossible. As much of the body as possible should be exposed, since the greatest advantage was to be gained by open air treatment, and at the Royal Alexandra Hospital for Children they liked to produce much tanning. Previous to 1924 the patients had been given open air treatment, but were covered with blankets and only put out sometimes. Now, once they were acclimatized, they had practically all of the body exposed. Previous to this method sinuses and recurrences had been common and the infected areas were large. Sinuses were now not common, and when present, healed more rapidly. The general condition of such patients was better. Reviewing the history of the disease, it was seen that ankylosis occurred earlier than it did in days gone by. Rollier appeared to be the only man who got those functional results. Of 150 of Rollier's patients, 92 were cured and function was restored in 48. Dr. Vickers thought that there must be a difference in the standard of what was called tuberculosis.

If the infection was under the surface of the neck of the femur, it could not strictly be called tuberculosis of the hip joint; it was tuberculosis of the bone. If the infection did not invade the joint, there was a chance of cure with movement. But once the articular cartilage was interfered with, ankylosis occurred, and ankylosis should be the aim. If the head and neck had been invaded and the shaft was out of the acetabulum, the condition might be improved by attempted ankylosis later on. Patients with ankylosed joints were known to walk, dance, swim and play football. At present the position was this: when tuberculous disease affected the joint, they should aim at ankylosis in the shortest possible time.

DR. J. C. B. ALLEN congratulated Dr. Wade on his most interesting paper, and could find nothing therein to criticize. In regard to Dr. Glissan's paper, he did not think that biopsy did any harm if it was performed by aspiration and not by incision. Many conditions were diagnosed as tuberculous joints which turned out to be due to some other infection, perhaps from a mastoid or from a tooth. There was no harm in putting the needle in. X ray reports were often misleading. Dr. Allen suggested that some more reliable test for cure should be substituted for the radiologist's report. A valuable criterion was irritability of the hip, which could easily be tested by rotation. If the hip was non-irritable, then the condition was quiescent (if not cured). A period of five years at least should be spent on treatment.

Dr. Glissan had spoken of incision of abscesses. Dr. Allen maintained that incision was never necessary and that aspiration would do everything that could be hoped from incision. Incision would inevitably mean secondary infection at some time, and the risk taken was too great, even though it might mean a quicker cure of the condition.

Calot's fluid was only of use when there was no bone destruction and when no sequestra were present. The spiculated sequestra would disappear in time. Injection was not going to do any good.

With Dr. Griffiths he was in entire agreement. Direct sunlight might be prescribed for treatment in England, where it was comparatively rare, but in this country there was plenty of sunlight. The good food and the hospital *régime* were the important factors. Dr. Allen did not think that tanning did any good. Every child in Australia could get quite sufficient sunlight without special treatment. Dr. Allen thought that the infection in joint tuberculosis began rather in the alimentary canal than in the bronchial glands. It was rare to find that the alimentary glands were not infected. Infection took place through the bowel and not through the air.

DR. P. L. HIPSLEY thanked the speakers for their interesting papers. He agreed with Dr. Vickers when he said that tuberculous disease in the neck of the femur was not to be called tuberculous disease of the hip joint. He had not yet seen a patient with undoubted tuberculosis of the hip joint recover with movement of the joint.

It was sometimes very difficult to diagnose the disease in its early stages, and the radiographer could not help at this stage. The surgeon, having made the diagnosis, put the child to bed after splinting and trusted that a subsequent X ray picture would reveal diseased bone, but this could occur only when the disease progressed in spite of treatment. To make certain of the diagnosis the Americans had adopted the plan of biopsy in doubtful cases, but mere needling of the joint was not reliable, as a "negative" finding would not necessarily indicate the absence of disease. Dr. Hipsley quoted a case in which a child had been diagnosed by several eminent surgeons as suffering from hip disease, and in which subsequent events proved that the correct diagnosis was appendicitis.

With regard to disability after hip disease, Dr. Hipsley quoted a case under his care in which both hip joints were quite fixed as a result of the disease, and yet the child could run quite well.

As regards plaster of Paris in the treatment of the disease, Dr. Hipsley had given up the method partly

because, to get proper fixation, it was necessary to put the plaster right up to the nipple line, on the side opposite to the disease, and hence efficient heliotherapy was not possible.

Dr. Hipsley thought that a little movement did not do any harm and that frequently children were kept too long at rest in bed. Dr. Hipsley said that they were always taught that tuberculous abscesses should never be opened, and in general he agreed with this, although sometimes it was difficult to evacuate the pus, except by open incision. Professor Starr, of Toronto, claimed excellent results after opening cold abscesses and then swabbing them out with iodoform gauze. If it was necessary to aspirate frequently, a sinus often resulted, and there were cases in which the correct treatment was to open the abscess by making an incision through healthy skin so that it could be closed again after evacuation.

DR. B. P. ANDERSON STUART said that the diagnosis of tuberculous disease of the hip joint in its earliest stages was difficult by X ray examination, since there were no signs to go by until clouding of the joint or erosion of cartilage or bone occurred. Once the condition was established, however, the radiologist could give the most valuable information with regard to progress. Dr. Anderson Stuart thought it probable that some of the patients with hip joint disease reported as having recovered with a full range of movement were in reality suffering from Perthes's disease, which might be confused by the inexperienced with tuberculous disease. The radiologist might also have difficulty in saying when healing was complete, since ankylosis did not occur evenly. Ankylosis might be complete in the upper half of a hip joint while there was still some activity of the tuberculous process in the lower half of the joint.

DR. GEORGE BELL agreed with Dr. Wade in what he had said regarding recurrence of tuberculous disease of the hip. Acute recurrences in adults were very rare, judging by the records of the Sydney Hospital. Most of the patients appeared to remain cured. They were made to realize what had already been stressed by Dr. Glissan, Dr. Wade and Dr. Griffiths, that this condition was a local manifestation of a general disease. The modern treatment of the disease was as much a general as a local treatment.

Dr. Wade, in reply to Dr. Griffiths, said that as a result of an investigation carried out at Edinburgh some years ago, it had been stated that nearly 100% of cases of joint tuberculosis were due to bovine tuberculosis. Further reports had since come to hand in which the number was now reduced to about 30%. In this country there was an astonishing number of patients with bone and joint tuberculosis who gave a history of direct contact with human tuberculosis. The bulk of human infection was probably transmitted through the portals of the lung. Rollier liked to see a multiple infection, which gave greater immunity and greater probability of cure.

Dr. Wade said that cases of infection in the neck of the bone did not necessarily concern the joint. Sometimes it was so close that it was impossible to say if it was going to ulcerate through.

As regards sunbaking and burning, Dr. Wade thought that there was a tendency to overdo it; the cult of sunbaking could be carried too far. Dr. Wade referred again to the fact that sandy-haired children who freckled in the sun, were more susceptible to tuberculosis and did less well than those who were pigmented.

In regard to incision and aspiration, Dr. Wade said that he himself incised and evacuated the abscess fully; lumps could not be got out through a needle. Those aspirated would continue to get abscess formation until the condition dried up. Dr. Wade had never found that sepsis occurred; but the skin of the incision became infected with small tuberculous ulcers, which cleared up easily enough in two or three months with exposure to the sun.

Dr. Royle had taken up issue with Dr. Wade over abduction and adduction. Dr. Wade still wished to take issue with him.

Dr. Glissan, in reply, said that he had evidently created a misapprehension in Dr. Griffiths's mind. He had not had the temerity to suggest the therapeutic use of tuberculin. The von Pirquet test should be used for diagnostic purposes only.

He had been most interested to hear the views of members of the Children's Hospital staff, because it was on their experience that others must rely. He had been particularly interested to hear the views expressed in regard to incision of a tuberculous abscess. In the few cases in which he had felt it necessary to incise such an abscess, his experience had been similar to that of Dr. Wade. But there certainly was danger. Incision should be performed only after using careful judgement.

He had evidently struck a jarring note in his reference to the use of plaster of Paris. But he had specifically exempted the Children's Hospital in mentioning this form of treatment. Plaster of Paris was used by him because it was the best he could do when it was impossible for him to have the patient under supervision. In the circumstances he was quite unrepentant. In disease of the hip joint the irritation could be made to settle down and deformity could be prevented by use of plaster of Paris. Dr. Glissan wished that they could accomplish this by other means, but they could not.

Dr. Glissan wished to remind Dr. Allen that he had been speaking of cured tuberculous disease of the hip and not of quiescent disease. If the disease was active they would always get signs. But after the late stages it was impossible to say by clinical diagnosis whether the disease was cured or not. They had to rely on the radiologist.

Dr. Glissan's only quarrel with the radiologist was that he did not see the patient clinically and did not appreciate the importance of what true ankylosis meant to the surgeon. It was not possible to foresee whether the condition would recur or not. Now and again an adult was seen in whom the disease had broken out afresh.

Correspondence.

STERILIZATION OF THE UNFIT.

SIR: While in entire agreement with the main ideas expressed in your leading article on "Sterilization of the Unfit" in your issue of November 21, I feel that a slightly erroneous conception of the value of sterilization may be gathered by those whose knowledge of the ætiology of mental deficiency is but slight.

It is, of course, true that some aments owe their mental deficiency to birth injuries, post-natal trauma and infection, and some to the fact of direct inheritance; but the whole problem of combating the increase of mental deficiency is rendered complex and difficult because the vast majority of the mentally unfit are born of parents who do not manifest the signs of mental deficiency.

My experience in institutions for the mentally defective, as well as in the psychiatric clinics in the large public hospitals in Melbourne, bears out this statement. The mother who brings her mentally deficient child to the clinic, is rarely herself deficient. Her other children usually show normal intelligence. The father is probably a steady-going labourer of average mentality. But on going further into the history we find that the father's sister suffers from epilepsy and the mother's maiden aunt had goitre and "went queer with her changes." Now no legislature would ever pass a law empowering the medical profession to sterilize a man because his sister took fits, or a woman whose spinster aunt had Graves's disease and "went queer with her changes."

Mental deficiency springs from the soil of mental deficiency; but its blossoms (or weeds) are as a mere flower garden compared to the forest of unfit which arises in that illimitable acreage of social subnormality and neuropathic stock in the community of the present day.

Dr. A. F. Tredgold, the leading British authority on mental deficiency, has written illuminatingly on the subject of sterilization, and has concluded that such a procedure, if legalized, would be attended by comparatively insignificant results in stemming the tide of mental deficiency in the community. While admitting that at

first sight sterilization would appear to offer the best solution of the difficulty, he believes, after due consideration of the facts, that "the bulk of defectives are the progeny, not of defectives, but of 'carriers' who may themselves show no marked mental abnormality. The effect of sterilization would, therefore, merely be to diminish the total number of aments by that relatively small proportion arising from defective parents. It is consequently a complete fallacy to imagine that sterilization would produce any appreciable difference in the total incidence of amentia."

Much the same argument holds good in regard to the insane. It is a lamentable fact that mental patients, allowed out on trial leave from the public and private mental hospitals, may beget children and thereby transmit a mental taint or even give birth to mentally deficient children. But the number of such children born of parents lately released from mental hospitals is negligible compared with the number of children born of parents who themselves have never exhibited any psychotic manifestation, but whose cousins or grandparents may have been criminals, drunkards, prostitutes, paupers or psychopaths.

It would be difficult indeed to make sterilization a condition to the discharge of a patient from a mental hospital. It would, in quite a large number of cases, be either unfair or unnecessary: unfair to those whose mental trouble arose solely from exogenous factors of physical disease, and unnecessary in those cases of psychosis following the climacteric, and in the pre-senile and senile cases recovered sufficiently to be allowed home in the care of relatives.

The sociological aspects of the sterilization of the mentally deficient and psychotic are extremely complicated. To me the procedure appears to have but limited application. Its introduction may work for evil as well as good. Sterilization of high grade aments at large in the community would undoubtedly foster increased sexual promiscuity, with an inevitable spread of venereal disease. If those aments who are now segregated in order to prevent their propagation of defective children, were sterilized, they would be turned loose as sexually harmless. (Otherwise, why sterilize them?) But the removal of one danger would only lead to the establishment of others. Sexually harmless, they are still economically incapable and socially inferior, which fact, couped with their specific attributes of waywardness, moral deficiency and irresponsibility, would, in the competitive conditions of modern life, render them an even greater burden to the community through the ranks of unemployment, pauperism and crime than they were formerly, when segregated.

The opinion recently expressed by Mr. Justice Humphreys in England was that any medical man who sterilized a defective would, "in the present state of the law, be acting illegally and without any legal justification." Weighing all the evidence and being fully cognizant of the advantages as well as the disadvantages of sterilization, mental hygiene councils might well seek legislative power to perform sterilization in that comparatively small group of cases where it is undoubtedly the most appropriate procedure.

Yours, etc.,
REG. S. ELLERY.

14, Collins Street,
Melbourne,
November 25, 1931.

SIR: My attention has been drawn to the leading article in your issue of the twenty-first instant, under the heading of "Sterilization of the Unfit." Were this merely an academic dissertation, it might evoke merely a passing interest; on the other hand, it may be taken as representing the general opinion of the profession in Australia, and therefore should not be allowed to pass unchallenged, especially in view of the wholesale nature of the advocacy contained therein with admittedly certain precautionary measures. The prolificity of mental defectives is greatly exaggerated, and they suffer a considerable handicap as far as their competition in the marriage market is concerned. As regards the 75% of moron or feeble-minded group, apart altogether from the question of transmission and spread of venereal disease by a section of sterilized defectives that may easily cause more national inefficiency than if the same member were allowed to procreate, sterilization in this group, proportionately very much greater numerically with its associated problems of moral instability, delinquency and anti-social trends, generally would not eliminate vice, crime, anti-social behaviour or personality disorders from such individuals, their supervision, care and treatment still being a State obligation and segregation ultimately a necessity. Castration, it is claimed, would undoubtedly in many instances act as a preventive against the repetition of criminal acts—so, it might be said, would a lethal chamber. It is astonishing that such a procedure, so maiming and so inhuman, and resulting in such destructive changes in the personality, the most precious of all man's possessions, should be advocated at the present day. One might be permitted to designate as atrocious the suggestion that provision should be made for the sterilization of patients with mental disease as a condition to their discharge from hospital, whether the discharge is temporary or likely to be permanent—that is to say, the mental deficient or mental case likely to be harmless if free from confinement, is to be given the option of sterilization and freedom or life-long incarceration. In the case of the former it would merely amount to a farce, as the patient would not understand the true significance of what he or she was consenting to, and in the case of a minor, consideration as far as the patient is concerned would appear to be of secondary importance. Further, there is no doubt that such a suggestion made to a psychiatric patient on discharge would bring in its train grave psychological effects, as well as undermining the confidence regained, in many cases often only as a result of patient and tireless efforts on the part of the psychiatrist while the patient was under treatment. It would be interesting to observe the effects of such a measure on the certifying general practitioner, who already often approaches his duty not without a certain amount of circumspection. The prospect of his patient being faced with such an alternative on discharge would, I venture to state, render him completely impotent as far as any legal obligation on his part was concerned. It is also stated: "A start might be made with defectives of the most pronounced types." If the writer cares to visit the Mental Hospital at Newcastle, an institution set aside for the care and treatment of mental defectives, I will be pleased to show him living examples of the types he writes about, and I have no doubt at all that he would be convinced of the futility of his advocacy of "making a start" with this particular type—a type that in practice has no chance of propagating, and as far as many of the higher grades are concerned, are too anti-social to live outside an institution.

Most of us believe that the civilized population of the world are, in regard to complete mental health, only heterozygous, and that mental defect is evidence of genetic variation, so that we find variants from the mean in both directions—and in every generation the recessives die out and the partials continue for ever. This variability is a necessity for all animal life, and attempting to do away with this would be doing away with the progress or even existence of the human race. Our knowledge of genetic science does not yet allow us to predict the result of any mating apart from warranting us in advocating any legislative sanction for sterilization.

It might be well to let us see just where we stand in relation to this matter. We have approximately 7,400 insane persons in mental hospitals in New South Wales; this means about 2,432 discharges that are permanent. Possibly half of these are socially or sexually in a position to procreate, that is, 1,216 insane suitable for sterilization. Of the 2,000 defectives confined in the institutions, it is highly improbable that more than 350 could live outside if sterilized. Of the remainder in the State, 9,600, less 2,000, that is, 7,600, at least half would be physically incapable of procreation, that is, 3,800 suitable for sterilization, making a grand total of about 5,366 to whom such method could apply, and this out of a total of 240,000 potentially neurotic or defective—in other words, approximately 2·3%. These figures have been arrived at as taking the percentage of defectives at four per thousand,

and the "submerged tenth" representing 4% insane, 4% defective, 2% recidivist. It is just to this extent, namely, 2·3%, that sterilization would diminish mental inefficiency, and when this has been accomplished and mental defect remains still unabated, let us hope the public will turn and rend "the ignorant, the notoriety seekers or the cranks" and not the members of our profession, who have given time and study to this difficult problem.

I would like, however, to see the prevention of the marriage of defectives advocated through the medium of your valuable columns with equal enthusiasm and the legislature convinced of the urgent nature of some such enactment, and in this connexion it might be of interest to quote a section of the report of the Board of Control of Lunacy in England and Wales. The Board states:

> In our view it would be a valuable safeguard if the marriage of defectives, whether under order or under supervision, could be prohibited by law. It is astonishing that on grounds of so called morality well meaning persons are found to countenance and even to encourage the marriage of defectives, who are not only obviously unfit to undertake the responsibility of parenthood, but are incapable of assuming the responsibility of the relationship into which they propose to enter. A definite prohibition of the marriage of defectives would prevent unions which are socially disastrous, and would make it much easier to secure the protection of young defectives under supervision or guardianship or on license by bringing home to the public conscience the anti-social character of any overtures towards persons definitely stamped as incapable of valid marriage.

I regret my reply has extended to such length, but I feel the importance of the subject warrants it and that I am merely expressing the consensus of opinion of my colleagues many years my senior, not only in age, but in experience and knowledge of psychological medicine.

Yours, etc.,

Mental Hospital,
Newcastle,
November 30, 1931.

GREY EWAN.

TRAUMA AND ORGANIC VISCERAL DISEASE.

SIR: In THE MEDICAL JOURNAL OF AUSTRALIA of November 21 Dr. F. S. Stuckey reports a case of intestinal obstruction due, as he and others consider, to muscular effort causing small bowel to become obstructed by an old adhesion. In this case the insurance company questioned the decision and was supported by medical witnesses who stated that the condition could not be caused by muscular exertion.

The following are reports of two cases, which are somewhat similar to the above case, but which were accepted by the insurance company concerned.

1. Mr. A. was carrying a plank where excavations were being made for the foundations of a building. While walking backwards, he accidentally stepped into one of these excavations and was severely jarred. He immediately complained of abdominal pain, but was able to continue at work for that day. Next day his pain was more severe and he stayed at home. Some three days later he was operated on for intestinal obstruction, and at operation a radial tear of his mesentery, three inches in length, was found, through which about three feet of small bowel had herniated and become obstructed. The edges of the tear had a rough appearance, and there were signs of recent adhesions between the bowel and the edges.

2. Mr. W., while at work doing heavy lifting, was seized with severe abdominal pain and was unable to continue at work. He developed intestinal obstruction, and at operation a band of old adhesions was found obstructing a coil of small bowel. He recovered, but since then has had two further operations for obstruction, and the company has, I understand, admitted liability for all three operations.

My legal friends advise me that the Act is still very "uncertain," but generally it is accepted that, provided an acute condition (such as intestinal obstruction) develop during occupation, the employee would be covered by workers' compensation, even though a chronic condition (such as an old adhesion or hernial sac) was present previously.

I, too, would be glad to see reports of further cases of this kind.

Yours, etc.,

December 2, 1931. J.K.H.

THE HOSPITAL PROBLEM.

SIR: In the issue of the journal, April 25, 1931, there appears a letter from Dr. D. M. Embelton in response to certain criticism of the Victorian Branch's insurance plan for medical service, contained in a letter of mine in the journal, February, 1931.

It was stated in my letter that, in connexion with the financing, the contribution by wage-earners was to be one penny per pound per week. Dr. Embelton in reply to this wrote: "Inquiry seems to indicate that the provision anticipated would be adequate only to pay part of the nursing cost." I am not sure whether Dr. Embelton realizes that, in addition to the tax to be paid by wage-earners, the Royal Commission recommended a similar tax on salaries and incomes. At the time of the Commission it was estimated that £260,000 would accrue from the tax on wages. With the revenue received from all sources, the full cost of nursing would be met.

At the present time the people who make the most use of the public hospitals pay least, and it was therefore considered that this provision of £260,000 by the wage-earners would be no hardship and would relieve the burden of the other people who had carried it so long.

In both the Victorian and New South Wales arrangements it will be very difficult to secure any hospital revenue from a large proportion of the wage-earners, because: (i) There is no provision for the imposition of a small wage tax; (ii) without this it is very difficult to collect from the people least able to pay even a proportion of the cost of their individual maintenance while ill in hospital.

The following statement by Dr. Embelton requires consideration: "The services of the public hospitals will be the right of the taxpayer in exchange for the tax, just the same way as in England the voluntary hospitals are at the disposal of the people in exchange for the payments of the contributory schemes."

In regard to the first part, such a state of affairs should not come about without the acquiescence of the profession, and in Queensland the Government could not easily find the amount of money required to provide the salaries for the provision of a free medical service.

As for the latter part, one was under the impression that, in the case of contributory schemes with the voluntary hospitals, part of the contribution is placed in a staff fund.

In Queensland there has been no attempt to introduce on a large scale contributory schemes. In some small centres where there are such schemes, the doctor does receive a proportion of the contribution.

It would appear that the metropolitan practitioners in New South Wales are willing to waive their rights to receive a proportion of the sixpence contribution, apparently being satisfied with the right of receiving fees from patients in intermediate and private wards.

There is something of value in all the plans (it would be interesting to know how that of Western Australia is working), and it is most unfortunate that there has not been ready and easy means available for the interchange of the ideas of the hospital committees of the various State Branches.

In conclusion, one wishes success to Dr. Embelton and our Victorian colleagues in their efforts, which will be watched with great interest.

Yours, etc.,

Wickham Terrace,
Brisbane,
December 5, 1931.

E. S. MEYERS.

Books Received.

MANUAL FOR MENTAL DEFICIENCY NURSES, by authority of the Royal Medico-Psychological Association; 1931. London: Baillière, Tindall and Cox. Demy 8vo., pp. 532. Price: 6s. net.

THE MANAGEMENT OF ABDOMINAL OPERATIONS, by R. H. Maingot, F.R.C.S.; 1931. London: H. K. Lewis. Crown 8vo., pp. 323. Price: 7s. 6d. net.

MANUAL OF HUMAN PHYSIOLOGY, by Sir Leonard Hill, M.B., LL.D., F.R.S., Hon. A.R.I.A.; Third Edition; 1931. London: Edward Arnold. Crown 8vo., pp. 476, with illustrations. Price: 6s. 6d. net.

RONALD ROSS, DISCOVERER AND CREATOR, by R. L. Mégroz, with a preface by Osbert Sitwell; 1931. Demy 8vo., pp. 282, with plates. Price: 10s. 6d. net.

DETACHMENT OF THE RETINA: A CONTRIBUTION TO THE STUDY OF ITS CAUSATION AND TREATMENT, by J. Ringland Anderson, M.B., B.S., F.R.C.S., F.C.S.A., D.O.M.S., with foreword by Sir J. H. Parsons; 1931. London: Cambridge University Press. Royal 8vo., pp. 221, with illustrations. Price: 20s. net.

PROCEEDINGS OF THE SECOND INTERNATIONAL CONGRESS FOR SEX RESEARCH, LONDON, 1930; Edited by A. W. Greenwood; 1931. Edinburgh: Oliver and Boyd. Royal 8vo., pp. 648, with illustrations. Price: 21s. net.

AN INTRODUCTION TO THE LITERATURE OF VERTEBRATE ZOOLOGY, compiled and edited by C. A. Wood, M.D., LL.D.; 1931. London: Humphrey Milford (Oxford University Presss). Demy 4to., pp. 662. Price: 3 guineas.

JOURNAL OF THOMAS WILLIAMS, MISSIONARY IN FIJI, 1840-1853, by G. C. Henderson, M.A.; Volumes I and II; 1931. Australia: Angus and Robertson. Royal 8vo., pp. 606, with illustrations. Price: 42s. net.

SEX HOSTILITY IN MARRIAGE: ITS ORIGIN, PREVENTION AND TREATMENT, by Th. H. Van de Velde; translated by H. Marr, M.A.; 1931. London: William Heinemann (Medical Books) Limited. Demy 8vo., pp. 312. Price: 17s. 6d. net.

THE COST OF ENGLISH MORALS, by Janet Chance, with an introduction by Sir Thomas Horder; 1931. London: Noel Douglas. Crown 8vo., pp. 127. Price: 5s. net.

MEDICAL EMERGENCIES, by Charles Newman, M.D., M.R.C.P.; 1931. London: J. and A. Churchill. Demy 8vo., pp. 138. Price: 8s. 6d. net.

SEEING RED: BEHIND THE SCENES IN RUSSIA TODAY, by E. G. Grady; 1931. New York: Brewer, Warren and Putnam; Australia: Angus and Robertson. Crown 8vo., pp. 257. Price: 6s. 6d. net.

Medical Appointments.

Dr. B. T. Mayes (B.M.A.) has been appointed Government Medical Officer at Boonah, Queensland.

* * *

Dr. W. H. Jamison (B.M.A.) has been appointed Government Medical Officer at Dunedoo, New South Wales.

* * *

Professor J. B. Dawson (B.M.A.) has been elected a Foundation Fellow of the College of Obstetricians and Gynæcologists.

* * *

Dr. H. W. Fitzpatrick has been appointed a member of the Board of the Devon Public Hospitals District, Tasmania, pursuant to the provisions of the *Hospitals Act*, 1918 (Section 13).

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, *locum tenentes*, sought, etc., see "Advertiser," page xiv.

HOMŒOPATHIC HOSPITAL, MELBOURNE, VICTORIA: Resident Medical Officer.

LAUNCESTON PUBLIC HOSPITAL, TASMANIA: Resident Medical Officer (Male).

MATER MISERICORDIÆ CHILDREN'S HOSPITAL, BRISBANE, QUEENSLAND: House Physician; House Surgeon.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Members desiring to accept appointment in ANY COUNTRY HOSPITAL, are advised to submit a copy of their agreement to the Council before signing, in their own interests. Brisbane Associated Friendly Societies' Medical Institute. Mount Isa Mines. Toowoomba Associated Friendly Societies' Medical Institute.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge Appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 65, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

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